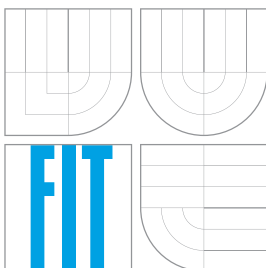


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BRNO UNIVERSITY OF TECHNOLOGY



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FACULTY OF INFORMATION TECHNOLOGY
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POSÍLENÍ PRINCIPŮ UX DO EXISTUJÍCÍCH UŽIVATELSKÝCH ROZHRANÍ

REINFORCING UX PRINCIPLES IN EXISTING USER INTERFACES

DIPLOMOVÁ PRÁCE

MASTER'S THESIS

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Abstrakt

Tato práce vysvětluje význam user experience, jaké jsou jeho hlavní aspekty, vybrané metody, jak může zasahovat do agilního procesu vývoje a na jaké úrovni může být v reálné firmě zastoupen. Taktéž se věnuje analýzou vybraných, již existujících uživatelských rozhraní pro ovládání síťového tisku a jejich koncových uživatelů. Na zmíněná rozhraní jsou pak opakovaně aplikovány vybrané metody prototypování a uživatelského testování. Vyhodnocení daných metod uzavírá práci spolu s doporučením zavedení procesů pro budoucí vývoj uživatelských rozhraní ve firmě Y Soft.

Abstract

This thesis explains meaning of user experience, its main aspects, selected methodology, its integration into agile development process and what UX maturity level can be represented in real company. It also deals with analysis of selected existing user interfaces used for network print management and its end users. Prototyping and user testing methods are iteratively applied to these user interfaces. Evaluation of these methods concludes the thesis with a recommendation what UX processes should be integrated for future development of user interfaces in Y Soft.

Klíčová slova

user experience, UX, uživatelské rozhraní, UI, uživatelský výzkum, persony, uživatelské testování, UX metriky, prototyp, použitelnost, evangelizace UX, Y Soft

Keywords

user experience, UX, user interface, UI, user research, personas, user testing, UX metrics, prototype, UX maturity, usability, UX evangelism, Y Soft

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Reinforcing UX Principles in Existing User Interfaces

Declaration

I declare that I have done this thesis independently under the supervision of Doc. Ing. Adam Herout, Ph.D. I have stated all used literature sources and publications.

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Peter Pilát

June 3, 2015

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Contents

1	Introduction	3
2	Background	5
2.1	What is User Experience	5
2.2	Main Aspects of UX	6
2.3	Selected UX Methodology	8
2.4	UX in Agile Development	13
2.5	UX Maturity	14
3	Problem Analysis	17
3.1	Company Overview	17
3.2	Product Description	17
3.3	Company Organization	21
3.4	Current UX Maturity Level	23
3.5	Observed Hypotheses	24
4	Implementation of UX Principles	25
4.1	Personas	25
4.2	User Testing	30
4.3	Iterative Prototyping	35
4.4	Raising Awareness of UX Activities	40
5	Results	42
5.1	Personas	42
5.2	User Testing	46
5.3	Integration of UX	52
5.4	Prototyping	55
6	Conclusion and Future Work	59

“Short cuts make long delays.”

- J. R. R. Tolkien

Chapter 1

Introduction

What makes product successful? Sure, there are many important factors but regardless of them, its success still hinges on just one thing — how users perceive the product.

“Does this product give me value? Is it easy to use? Is it pleasant to use?”

User experience design (abbreviated as UX) is all about striving to make users answer yes to all of those questions. These questions run through the minds of users as they interact with the product and will form their decision whether they will use, buy or like the product.

Those who work on UX are called UX designers. They study and evaluate how users feel about a system, looking at such things as ease of use, perception of the system, utility, efficiency in performing tasks and so forth. Not everyone sees the value of having a UX specialist on the team. Arguments against hiring revolve around the perceived associated costs, redundancy in skill set and fear of change. A counter-argument is that we should look at UX design as an investment. Although the benefits of UX are not as apparent as those of other parts of the website or application, it can lead to higher returns later on. I will provide two of the prime examples in IT industry.

Firstly, a simple change of a button could increase a website’s annual revenue by \$300 million. It’s hard to imagine a form that could be simpler: two fields (Email Address and Password), two buttons (Login and Register), and one link (Forgot Password). Yet, it turns out this form was preventing customers from purchasing products from a major e-commerce site. What was even worse — designers of the site had no clue there was even a problem. It’s a form users encounter all the time. How could they have problems with it?

The UX designers fixed the problem simply. They took away the Register button. In its place, they put a Continue button with a simple message:

“You do not need to create an account to make purchases on our site. Simply click Continue to proceed to checkout. To make your future purchases even faster, you can create an account during checkout.”

Results — the number of customers purchasing went up by 45%. Extra purchases resulted in an extra \$15 million the first month. For the first year, the site saw an additional \$300 million.

Second example discusses the story of Barack Obama’s fund raising campaign in 2012. The Digital team concentrated on optimizing everything related to project — from web pages to emails. Their success dwells in usage of specific popular UX method, the a/b testing. Overall, they executed about 500 a/b tests in a 20 month period which increased

donation conversions by 49% and sign up conversions by 161%. This yielded very interesting findings how user behavior is influenced by variables like design, copy, usability, imagery and page speed. In the end they beat the expectations and raised \$1.1 billion total (\$690 million of that came through various web properties).

Mentioned examples sounds very nice, but the discipline of UX reaches further than that. In my thesis, I will illustrate the real world issues which UX designers have to face. In the first chapter, I will explain background of user experience, UX maturity model, selected UX methods, main aspects of user experience, and integration of designers into agile development process. These selected methods will be applied to a product from real company with existing user interfaces. The reader will be informed with this product, company organization, and their current status of UX maturity. My mission is to devise and realize experiments based on my observations as a UX practitioner in this company. The reader will be familiar with my process and results of carried UX methods. I will also describe activities which led to user experience awareness raising and buzz generation. At the end, I will mention what have I accomplished and what benefits or changes did my activities bring.

Chapter 2

Background

“The human mind is exquisitely tailored to make sense of the world. Give it the slightest clue and off it goes, providing explanation, rationalization, understanding. Consider the objects — books, radios, kitchen appliances, office machines and light switches — that make up our everyday lives. Well designed objects are easy to interpret and understand. They contain visible clues to their operation. Poorly designed objects can be difficult and frustrating to use. They provide no clues — or sometimes false. Alas, poor design predominates. The result is a world filled with frustration, with objects that cannot be understood, with devices that lead to error.”

- Donald A. Norman [1]

This chapter deals with explanation of user experience background. I am describing the main aspects, popular UX methods, integration of UX into agile development, and maturity model of UX.

2.1 What is User Experience

The term “user experience” was firstly introduced in 1995 at CHI conference by three designers working at Apple - Donald Norman, Jim Miller and Austin Henderson [2]. They coined the term as preferred to “human interface research and application” due to the organizational structure. Many user experience definitions exist nowadays, nevertheless they somehow differ. The International Organization for Standardization defines user experience as¹:

“Person’s perceptions and responses resulting from the use and/or anticipated use of a product, system or service.”

In article *What Is User Experience Design? Overview, Tools And Resources* located on Smashing Magazine website (popular UX resource web magazine), Jacob Gube defines UX as [3]:

“User experience is how a person feels when interfacing with a system. The system could be a website, a web application or desktop software and, in modern contexts, is generally denoted by some form of human-computer interaction.”

¹ISO 9241-210:2010 Human-centered design for interactive systems

Here is another famous definition of UX by Nielsen Norman Group (founded by Jakob Nielsen and Donald Norman) [4]:

“User experience encompasses all aspects of the end-user’s interaction with the company, its services, and its products.”

During my 2 years practice of user experience designer I met with many people who asked what is my job — none of these definitions were understandable enough. The best elucidation is explaining them to imagine their experience of nice dinner in restaurant (reservation, waiter approach, recommendations, great meals etc.) and then making the associations with website or computer application.

The user experience design process is all about ensuring that no aspect of the user’s experience with your product happens without your conscious, explicit intent. This means taking into account every possibility of every action the user is likely to take and understanding the user’s expectations at every step of the way through that process. Breaking the job of crafting the user experience down into its component elements, we can better understand the task as a whole [5].

2.2 Main Aspects of UX

I will describe main aspects of user experience in this section. Of course, one can say that following aspects are only a part of the UX — I would not oppose, there are others such as copywriting, data visualization, some parts of marketing, industrial design, etc. I have decided to select the most important aspects from my point of view. I have come across all the following aspects in almost every book with user experience topic I have read. These constituent parts affect the user experience the most — user research, usability, interaction design (often abbreviated as IxD), visual design (same as IxD, often abbreviated as VD), and information architecture.

2.2.1 User Research

User research is the process of figuring out how people interpret and use products and services [6]. It is used everywhere from websites, to mobile phones, consumer electronics, medical equipment, banking services, and beyond. Interviews, usability evaluations, surveys, and other forms of user research conducted before and during design can make the difference between a product or service that is useful, usable, and successful and one that’s an unprofitable exercise in frustration for everyone involved. After a product hits the market, user research is a good way to figure out how to improve it, to build something new — or to transform the market altogether. Basic user research is easy, fast, and highly effective. Some forms can be done with any product.

2.2.2 Usability

Usability is the pragmatic component of user experience, including effectiveness, efficiency, productivity, ease-of-use, learnability, retainability, and the pragmatic aspects of user satisfaction [7]. The ISO 9241-11: Guidance of Usability (1998) provides the definition of usability:

“The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”

The effectiveness is the accuracy and completeness with which specified users can achieve specified goals in particular environments. Efficiency reflects the resources expended in relation to the accuracy and completeness of goals achieved. The satisfaction means the comfort and acceptability of the work system to its users and other people affected by its use.

2.2.3 Interaction Design

Alan Cooper defines interaction design as practice of designing interactive digital products, environments, systems, and services. Like most design disciplines, interaction design is concerned with form. However, first and foremost, interaction design focuses on something that traditional design disciplines do not often explore — the design of behavior [8]. It is concerned most significantly with satisfying the needs and desires of the people who will interact with a product or service. The essence of good interaction design is devising interactions that achieve the goals of the manufacturer or service provider and its partners while supporting user goals. Interaction designers take several questions into consideration [9]:

- What layout pattern would work best?
- Which features and information are of higher importance, and how do I draw users’ attention to them?
- How should I incorporate the user feedback I am getting from user research, user surveys, and formative and summative usability testing?
- What behaviors occur on dragging and dropping, on mouse over, and so on?
- How can I communicate the strengths of a feature or application?
- How can I satisfy users’ primary needs and support the tasks that let them achieve their goals?
- How can I draw on users’ intuition to get them to the next step?
- How can I ensure users are aware they’re performing a subtask that’s part of a greater task they’ve started?
- How can I use the UI components that are available to me — such as grids, tabs, and panels?
- How can I maintain consistency throughout the application?

2.2.4 Visual Design

Visual design attempts to solve communication problems in a way that is at once functionally effective and aesthetically pleasing [10]. It is the first and the last part of the user interface observed by the user. Good visual design can improve all of system usability components — such as ease of learning, efficiency of use, memorability, reduced number of

user errors, and subjective satisfaction. It also helps to build the trust of the users and interest in the brand. The visual design is a vast field of UX and I could write further characteristics. However, I will not be dedicating so much effort to visual design in my thesis — that’s why I want to keep this explanation brief.

2.2.5 Information Architecture

The information architecture is a specification of the navigational structure of the website or application. It does not involve any visual design. Designers must design information architectures in a way that streamlines site visitor navigation across and within tasks and exploits the capabilities of automation (to enhance ease of use), while at the same time preserving familiar structures that tap into visitors’ current mental models of their tasks [7]. Information architecture supports usability and findability. Findability is a crucial factor for information architecture — if users are not able to find required information without browsing, searching or asking, then the findability of the information architecture fails.

2.3 Selected UX Methodology

The field of user experience has a wide range of research methods available, ranging from tried-and-true methods such as lab-based usability studies to those that have been more recently developed, such as unmoderated online UX assessments. While it’s not realistic to use the full set of methods on a given project, nearly all projects would benefit from multiple research methods and from combining insights. The following list aggregates most common methods and deliverables produced by UX designers and UX researchers — personas, consumer journey map, usability tests, user stories, ethnographic field studies, focus groups, eye tracking, diary studies, card sorting, a/b testing, interviews, heuristic analysis, wireframes, prototypes, design guidelines, etc.

Deciding when to use what method is tricky — the key question is what to do when. In this thesis I have used personas, usability tests and prototypes.

2.3.1 Personas

Personas are fictitious, specific, concrete representations of target users. The notion of personas was created by Alan Cooper and popularized in his book *The Inmates Are Running the Asylum: Why High Tech products Drive Us Crazy and How to Restore the Sanity* as a way to empathize with and internalize the mindset of people who would eventually use the software he was designing. Personas put a face on the user — a memorable, engaging, and actionable image that serves as a design target.

In other words, personas helps UX designer and its organization to become more user focused [11]. Personas are necessary foundation of good interaction design. Personas are not real people, but they represent them throughout the design process. They are hypothetical archetypes of actual users [12].

Figure 2.1 shows an example of persona for company Acme Professional Association for CPAs². Another clearer example may be a kid — boy in age of 7 to 12 from Europe who likes skating. This was one of the most typical personas for LEGO company [6]. While

²Certified Public Accountant (CPA) is the title of qualified accountants in numerous countries in the English-speaking world



GARY GETTING STARTED

QUOTE

"Yeah, I could build a career being a CPA, but is it the right thing for me? It's been a lot of work to get where I am and maybe it's crazy to change plans now, but I'm already so burned out!"

PRIORITY - PRIMARY

Gary is exactly who we want to help. If we help him now, he will be loyal to us for the rest of his career. Also, he is radically underserved by other organizations.

MEET GARY

Gary is 25 years old and has been working for a CPA firm for 3 years. He just earned his CPA certification last year, but he's burned out from working too many hours in recent months and is questioning whether he's made the right career choice. When it's not tax season, Gary goes out a couple of nights a week with other young people he works with, but he's met few other people since he moved after college. Even though he theoretically has "flex time," Gary blames his lack of outside involvement on his crazy work hours. Gary is also questioning whether he should be doing something more meaningful with his life, whether within or outside of his career.

Gary's employer chooses the continuing education courses he gets to attend and pays for his professional association memberships. His employer is also encouraging Gary to get involved on boards or in leadership positions outside of the organization to advance his career.

GARY'S GOALS

- I want to figure out what I really want to do with my life.
- If I decide to change careers, I want to figure out what my options are!
- Whatever I end up doing, I want to build it into a career.
- I want my work life to be less overwhelming.
- I want to meet more people ... both professionally and socially.
- I want to find some activities to participate in that benefit society at-large and that I can accommodate to my schedule.
- I want discounts on purchases that benefit me personally, rather than professionally.

GARY'S QUESTIONS IN HIS OWN TERMS

- Where can I find and interact with people like me?
- Where can I find career and personal development resources?
- Are there value-adds to membership that will benefit me personally?

HOW WE WANT TO ANSWER GARY'S QUESTIONS

- The Acme Society of CPAs is the best place to connect with people like you.
- We have a number of sponsored programs that are fun and will fulfill your community service and personal development goals.
- We have many volunteer opportunities that are flexible enough to work within your time constraints that will support your career development goals.
- We are the best portal to connect you with other discount opportunities to benefit you personally.

WHAT WE THINK GARY SHOULD KNOW

- Even if you decide to change careers, we're here to help. There are lots of ways the hard work you've done so far can benefit you in other careers.
- The CPA designation positions you well for many career options.
- There are fulfilling careers available for CPAs both in traditional and nontraditional roles.

Figure 2.1: An example of persona. Source: *The Essential Persona Lifecycle* [11]

a persona is usually presented as a one-pager document, it is more than just a deliverable — it's a way to communicate and summarize research trends and patterns to others. This fundamental understanding of users is what's important, not the document itself [13]. The persona should include user goals, needs, narrative of its typical day, meaningful and suitable quote, and priority score.

Personas can and should be used throughout the creative process, and can be utilized by all parts of a software development and design team, and even entire companies [14].

Building Empathy

When designers create personas, they are crafting the lenses through which they will see the product through. With persona glasses on, it's possible to gain a similar perspective

to that of a user. From this point, when designers make decisions, they do so with an internalization of a persona's goals, needs, and wants.

Developing Focus

Personas help define who the software is created for, and who will not be part of the focus. Just by defining who your users are, it makes it more apparent that you can't design for everyone, or at least not everyone at once — or you risk designing for no one.

Communication and Forming Consensus

As a deliverable document, personas help communicate research findings to those who were not able to be a part of user interviews. It's also much more comfortable to use references to personas in communication rather than explaining the role of a user all the time.

Making and Defending Decisions

When a design choice is brought into question, defending it based on real data and research about users (represented by a persona), is often the best way to persuade and convince others to see the logical and user-focused reasoning behind the design.

Measure Effectiveness

Personas can be stand-in proxies for users when budget or time doesn't allow for people to take part in the iterative process. Various implementations of a design can be tested using a persona paired with a scenario in a similar way as a design is tested with real users.

2.3.2 Usability Testing

User Experience Testing has several names — UX testing, usability testing, user testing. They all refer to the process of understanding what users do and why they do it.

The term usability testing is often used rather indiscriminately to refer to any technique used to evaluate a product or system. It is a process that employs people as testing participants who are representative of the target audience to evaluate the degree to which a product meets specific usability criteria. This inclusion of representative users eliminates labeling as usability testing such techniques as expert evaluations, walk-throughs, and the like that do not require representative users as part of the process. The usability test will tell whether audience can use the product. It helps identify problems people have with a specific interface and reveals difficult-to-complete tasks and confusing language.

Usability testing is a research tool with its roots in classical experimental methodology. The range of tests one can conduct is considerable, from true classical experiments with large sample sizes and complex test designs to very informal qualitative studies with only a single participant. Each testing approach has different objectives, as well as different time and resource requirements [15].

Methods of User Testing

I will just mention methods that are relevant to the content of this thesis — lab research, guerrilla research, and hallway tests³.

Lab research describes usability tests conducted in a highly-produced, simulated environment. Researchers typically observe the test behind a one-way mirror and employ screen-capturing software, video cameras, etc. to document the test. This can be achieved by having usability lab.

Guerrilla research is a modern, lightweight take on lab research. Instead of renting a lab, guerrilla research is typically done on the spot — users are simply asked to complete basic tasks with a website or service. The term “guerrilla” refers to “it’s out in the wild style”, in the fact that it can be conducted anywhere — cafe, library, train station, essentially anywhere where is significant footfall. This approach is relatively easy to set up and helps validate/invalidate critical assumptions at cheap cost and with rapid speed. Participants are not recruited, but are approached [16]. Guerrilla usability tests usually result in an email summary or a quick stand-up report in a status meeting [6].

A hallway usability test is where you grab the next person that passes by in the hallway and force them to try to use the code you just wrote [17]. Or prototype. The name of the technique refers to the fact that the testers should be random people who pass by in the hallway. The theory, as adopted from Jakob Nielsen’s research, is that 95% of usability problems can be discovered using this technique [18].

2.3.3 Sketching the User Experience

User experience practitioners combine design theory and user knowledge into visual ideas — wireframes, mockups or prototypes — before applying any style or branding. “Mockups” is the term often used for wireframes that have been created in high fidelity, but for some people these three terms are interchangeable. In this thesis I will be using two of those terms — wireframes and prototypes. Basically, a wireframe is a rough guide for the layout of a website or app. Usually it is a sketch on paper. The biggest benefit of prototypes is that it is much cheaper to change a product early in the development process than to make change after the development. Prototyping allows gathering feedback from users while still planning and designing the product itself.

A prototype is similar in that while far from being a polished product in terms of visuals or functionality, but it gives an indication of the direction that the product is heading. Prototypes are widely recognized to be a core means of exploring and expressing designs for interactive computer artifacts. It is common practice to build prototypes in order to represent different states of an evolving design and to explore options [19]. This exploration can be done via user tests. Often web and software designers make prototypes with more than one technique, moving closer to the final production methods as the design progresses to completion. Prototypes more similar to the final product are “high-fidelity” while those less similar are “low-fidelity”. A high-fidelity prototype is often made with the same methods as the final product and hence has the same interaction techniques and appearance as the final product, but is more expensive and time-consuming to produce than a low-fidelity prototype [20].

³if you are interested in user testing methods such as eyetracking, remote usability testing, etc. take a look at the book *Observing the User Experience* [6]

Low-fidelity Prototypes

Low-fidelity prototypes are often paper-based and do not allow user interactions. They range from a series of hand-drawn mockups to printouts. In theory, low-fidelity sketches are quicker to create. Low-fidelity prototypes are helpful in enabling early visualization of alternative design solutions, which helps provoke innovation and improvement. An additional advantage to this approach is that when using rough sketches, users may feel more comfortable suggesting changes [21]. It has proven for me to use thick marker for low-fidelity prototyping. It is uncomfortable to focus on detail with thick marker — that helps to focus on the most important parts such as layout and interaction and the sketching is faster.

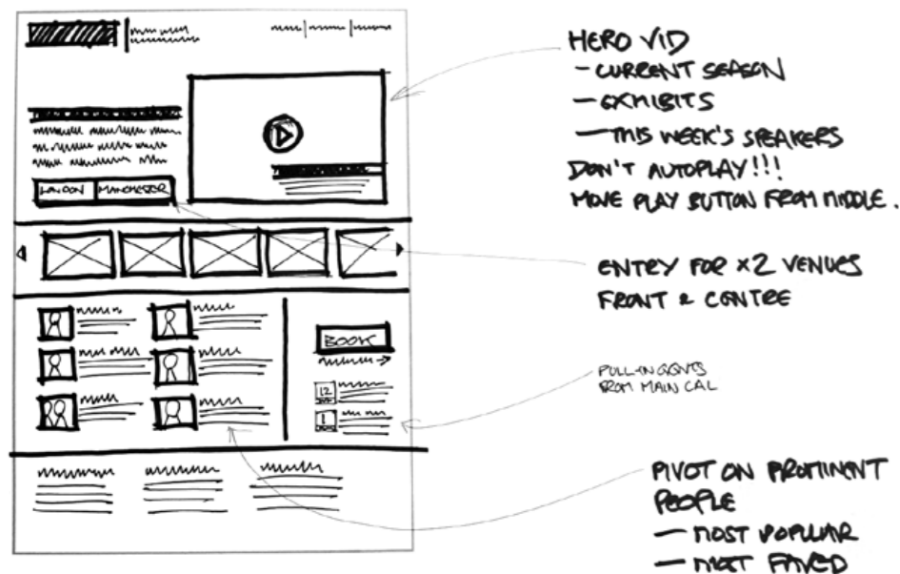


Figure 2.2: An example of low-fidelity prototype. Low-fidelity prototypes are often paper-based. Source: *Undercover User Experience* [22]

High-fidelity Prototypes

High-fidelity prototypes are computer-based, and usually allow realistic user interactions. They take user as close as possible to a true representation of the user interface. High-fidelity prototypes are assumed to be much more effective in collecting true human performance data and in demonstrating actual products to clients, management, and others.

Prototyping Tools

There is a variety of tools for prototyping besides paper, pencil, sticky notes, and markers. They are paid or free. Few of the most common prototyping tools are:

- The Omni Group OmniGraffle⁴

⁴from \$99.99; available at <www.omnigroup.com/products/omnigraffle>

- Balsamiq Mockups⁵
- InVision app⁶
- Axure RP⁷

OmniGraffle is an iOS desktop and tablet application that features mostly design tools. Although OmniGraffle is an UX industry tool, it lacks interactivity capabilities and is not easily used for team collaboration due to its limitations as a desktop and tablet application.

Balsamiq Mockups is a simple graphical user interface mockup builder application. Balsamiq supports collaborative designing and in real-time iteration. Most of the time, the outcomes are low-fidelity prototypes. The application is offered in a desktop version as well as a plug-in for Google Drive, Confluence and Jira. Balsamiq primary focuses on rapid designing.

InVision is a web-based prototyping tool that supports real-time design presentation and collaboration. Typical workflow is to upload visual designs, add hotspots, and transform static images into clickable, interactive prototypes. It also supports communication about uploaded prototypes by involving clients or colleagues.

Axure RP is great for detailed prototypes — it is able to simulate almost all the mobile app or website interactions. Axure allows generating HTML prototype and it's possible to load the prototype onto a desktop or mobile — allowing users to gain a feel for the product and its functions. These added simulations come at a cost, though. It is labour-intensive and lacks the same flexibility as low-fidelity tools — in that it requires a great deal more time and effort to make changes and iterations.

2.4 UX in Agile Development

As more organizations adopt agile development practices, user experience practitioners want to ensure that the resulting products are still designed with users in mind. The user experience team in Autodesk have also experienced similar problem in 2002 [23]. I have presented their paper at HCI group at Faculty of Information Technology of Brno University of Technology. The paper deals with adaptations to the timing, granularity, and reporting used for agile interactive usability investigations, with an intended audience of usability practitioners.

The agile development lifecycle is characterized as a series of incremental mini-releases. Each mini-release, with a subset of the features for the whole release has its own requirements analysis, design, implementation, and quality assurance phases, and is called a working version. A key principle of their UX team is design iteration — they needed to be able to catch design failures early, change designs as many times as needed, and then incorporate the design fixes. To do this, the work was done in an Interaction Designer Track while developers worked in a separate and parallel Developer Track, see figure 2.3. Cycle 0 is the brief requirements-gathering phase at the start of the project. Usability investigation activities in Cycle 0 depend on whether the product is the next release of an existing product or completely new. They can include the following activities — data gathering, interviewing or conducting contextual inquiries, preparing designs, analyzing and summarizing usability

⁵from \$79; available at <www.balsamiq.com/products/mockups>

⁶free; available at <<http://www.invisionapp.com/>>

⁷from \$289; available at <<http://www.axure.com/>>

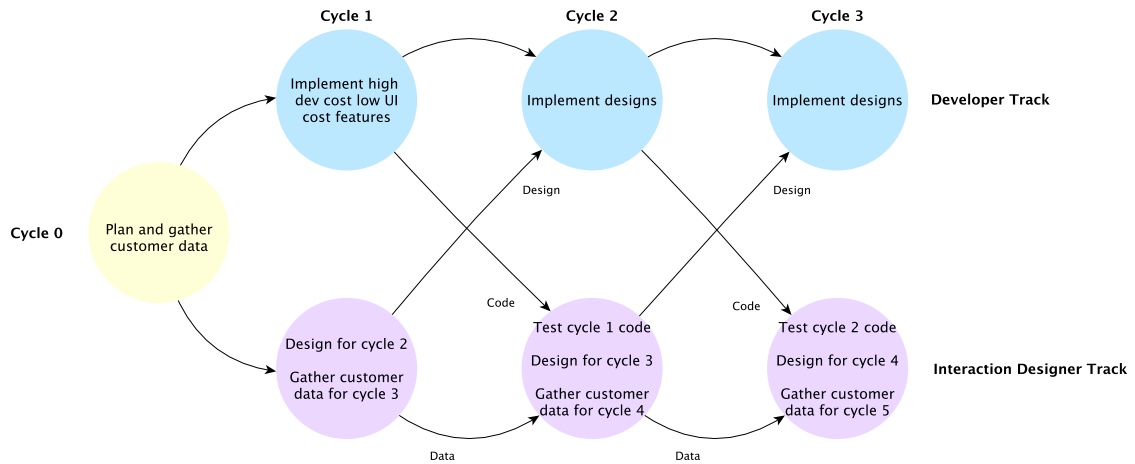


Figure 2.3: To allow the UX team to iterate on designs, they tested prototypes at least one cycle ahead of developers, and then passed on the validated designs to be implemented. They have also conducted contextual inquiry for workflows at least two cycles ahead, and usability tested the implemented working version to check for design drift. Source: *Adapting Usability Investigations for Agile User-centered Design* [23]

test data, and developing brief workflows. In Cycle 1, activities can include — designing prototypes for Cycle 2, and conducting rapid formative usability testing to refine their design, and conducting contextual inquiry and interviews to investigate designs for Cycle 3. Following cycles includes the same activities, but the addition is a usability testing of the implemented working version from the previous cycle. I will mention just a few reflections of their work:

- More of the product is designed than before.
- Usability investigations are conducted throughout the entire product release lifecycle, rather than clustered at the front end of a release, or in the prior release.
- The most important designs are worked on first, and there is no effort wasted writing unused designs.
- Product changes suggested by usability testing and contextual inquiry investigations of the actual product can be implemented in the current release.

2.5 UX Maturity

UX Maturity simply explains how well is UX adopted in company. I have decided to use Vetrov's Maturity model, which is based on three levels of UX maturity [24]. As shown in figure 2.4:

1. Operational — the designer is just an implementer, working on individual design tasks and creating design deliverables

2. Tactical — the designer is an integral part of a product team and deeply integrates design into other product development tasks and processes
3. Strategic — the designer is a visionary or product owner who influences strategic decisions on how to evolve a product.

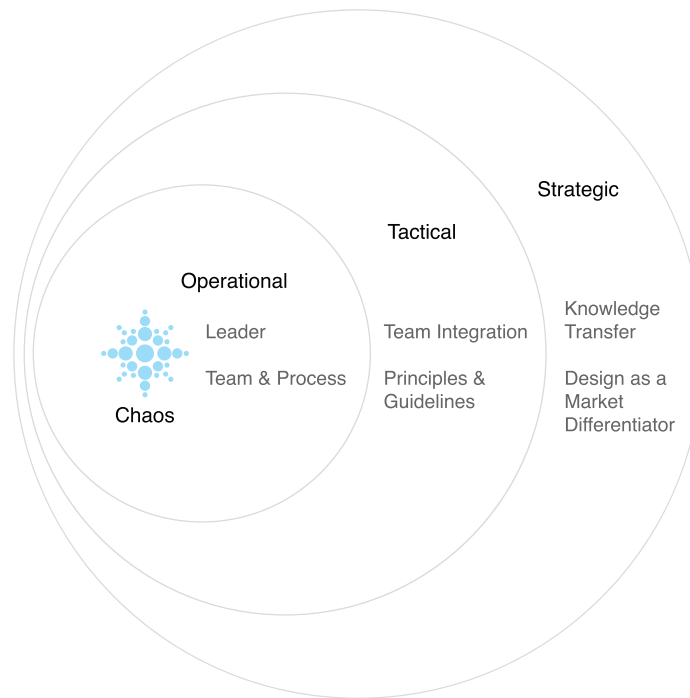


Figure 2.4: Vetrov's Maturity model with three levels — **operational**, where UX designers are only implementers, **tactical**, where UX designers play an integral role on product teams, **strategic**, where UX designers serve as product owners and influence strategic decisions. Source: *Applied UX Strategy, Part 1: Maturity Models* [24]

These maturity levels indicate how deeply designers become engaged in product and business management. For each level of UX maturity, there are basic criteria for achieving that level, plus progressively more sophisticated activities for maintaining sustainable growth. Sustainability is a critical part of establishing a systematic approach to design, as well as ensuring predictable quality.

2.5.1 Operational Level

At the operational level, a UX design team is merely an implementer. The team executes incoming design tasks and creates design deliverables. Design quality is random — developers are either on their own or the design is being outsourced. When company wants to begin systematic design approach, it usually hires a UX leader. The UX leader shows where are problems and how to solve them. The company initiates a program of user research and analytics. They achieve some first successes, product changes, and relaunches.

Afterwards company sets up a UX team, which establishes a design process, does short-term and mid-term planning, and appoints a clear way of assigning and approving tasks. The team chooses their optimal tool set for creating wireframes, prototypes, mockups,

and other deliverables. The team outsources UX resources and involves them in solving either tasks that are not related to product design or in helping with design when there is too great a workload for the team. They also establish learning, training, and skills-improvement programs to grow designers professionally and should regularly contribute to product updates.

2.5.2 Tactical Level

The UX designers play an integral role on product teams. Design is deeply integrated with other product development tasks. The UX team can demonstrate the value of User Experience to every product and project manager. UX design team gains authority, credibility, and trust and always gets heard. All design decisions get made up front by the UX team — developers, testers, and marketers trust UX designers, they often contact designers directly to solve ongoing problems. A quality-assurance process gets set up and covers design implementation reviews, usability testing, and ensures designs solve business goals. Products become more consistent as the UX team establishes common visual-design elements, interaction principles, and information architecture patterns.

Supporting the company's current products and launching new ones gets easier. That's because of unification of the company's portfolio through uniform visual design and interaction principles. UX team provides scalable design solutions, creates UX design guidelines that specify visual design, interaction design and information architecture. Design principles guide the company's efforts in building and evolving products. These are high-level commandments that help the team to choose the best design decisions from several alternatives. The entire product portfolio gets updated to conform to unified UX design guidelines and standards. The user experience is consistent across the entire portfolio of products.

2.5.3 Strategic Level

The members of the UX team serve as visionaries or product owners and influence strategic decisions on how to evolve a product. Most important is knowledge about users and how they interact with product user interfaces. The company learns from its mistakes. There is a unified knowledge base that documents how users work with the company's products, ongoing competitor analyses, and design and technology trends. This includes analytics and user research data, market and competitive research, and customer feedback. New product and feature ideas come from the bottom up—from UX researchers and designers to product managers.

The company has its own visual design and interaction language that influences the industry — UX design patterns and solutions get copied by competitors and help to launch design trends. Everyone on the product team has at least basic design skills.

Vetrov says that the higher the UX maturity level, the better products will be as a result and will also be much easier to sustain this level of quality [24]. There is no universal theory of maturity models, there are many others which are not so well described such as Design Ladder, Corporate Usability Maturity Stages, Normal Modes's UX maturity model, or Simon Herd's usability maturity model. At first, I thought of using Simon Herd's maturity model, but at the end of my practice in Y Soft I have decided to use Vetrov's maturity model due to the adaptability of my situation. I recognized the individual maturity levels and realized that Vetrov's model suits very well.

Chapter 3

Problem Analysis

3.1 Company Overview

Y Soft was founded as university spin-off in 2000. It has become a globally-operating company providing scalable print system management solutions (software and hardware) that enable companies and organizations to control costs, reduce waste, increase convenience for users, and have a positive effect on the environment. This solution is called SafeQ and is available worldwide through partner network. This means that Y Soft operates as business-to-business (B2B) company. SafeQ is used by more than 8,000 organizations in 100 countries.

Y Soft has built strategic alliances with multifunction printer manufacturers, such as Konica Minolta, Xerox, Ricoh, HP, Sharp, and Toshiba. Another strategic step forward was to develop partnerships with major card reader producers worldwide — such as Legic, HID, Philips etc. Y Soft Group employs more than 230 people, of whom 180 are located in the Czech Republic — headquartered in Brno. More than 90 percent of its production is being exported.

3.2 Product Description

Y Soft's main product is SafeQ — print management solution that gives you control over printing, copying and scanning throughout your company. It helps organizations to efficiently manage and optimize their reprographic equipment and to track and account every print, copy, and scan at the user, department, project, and device level.

SafeQ enables the administrator to define fixed rules and allocate roles to specific employees within the company. How a user can print is defined by their role (e.g. those with accounting roles may only be allowed to print in black-and-white, while those with marketing roles may be allowed to print in color). It also ensures that users of MFPs are always identified through ID cards, passwords or PINs — and the system controls their access and rights. Users can pick up their print jobs at the printer of their choice. Educational institutions and other organizations can use Y Soft SafeQ to charge for printing.

SafeQ is a complex solution. It consists of three main components:

- Distributed Server System
- Desktop Client
- Terminal

In this thesis I will dedicate my effort to deliver better user experience of embedded and external terminals. To understand why terminals — it's the main interaction point of SafeQ which cannot be avoided to perform basic printers operations. Current version of SafeQ brings new browser-based embedded terminal. Terminal user interface is implemented with HTML and CSS and the SafeQ application logic is implemented in .NET or Java. This doesn't apply to all vendors, not all the terminals are browser-based. Native embedded terminal for Ricoh and Konica Minolta are not browser-based. Ricoh presentation layer is implemented in Java and native Konica Minolta uses set of specific templates. The main characteristic feature is that every external and embedded terminal keeps consistent graphical interface regardless of the display properties — resolution, ppi¹ or technology (resistive/capacitive touchscreen).

3.2.1 Interacting with MFP

Key components of all Y Soft SafeQ print solutions are terminals that provide user identification, print security, and print job management. Y Soft supplies two types of external hardware terminals, as well as embedded software terminals for a variety of multifunctional printers (abbreviated as MFP).

Terminal UltraLight

There are two models of UltraLight terminals: Print and Print & Copy. The Print terminal provides secure printing and enables prints to be tracked and accounted. The Print & Copy terminal provides all the functions of the Print model, as well as copy and other functions.



Figure 3.1: Terminal UltraLight Print & Copy

Terminal Professional

The Professional terminal includes a color touchscreen and offers all the features of the UltraLight terminals, as well as the ability for users to manage print jobs, save jobs as Favorites, and delete jobs — all directly at the printer. The Professional terminal also enables users to enter billing codes for project-based accounting. This terminal is solution to all MFPs which does not support Y Soft SafeQ embedded terminal. It's connected to

¹Pixel per inch is a measurement of pixel density of devices

MFP via blocking cable. Whole process of production falls under Y Soft. Hardware is being designed in Prague and assembled in Brno.



Figure 3.2: Terminal Professional v3.5 with embedded card reader

Embedded Terminal

Y Soft supplies software-based embedded terminals for MFPs from a variety of manufacturers. These terminals are embedded in the MFP and utilize the MFP's interface for user input. Card readers can be used with the terminals for authentication via card. Embedded terminals support all MFP operations — printing, copying, and scanning.

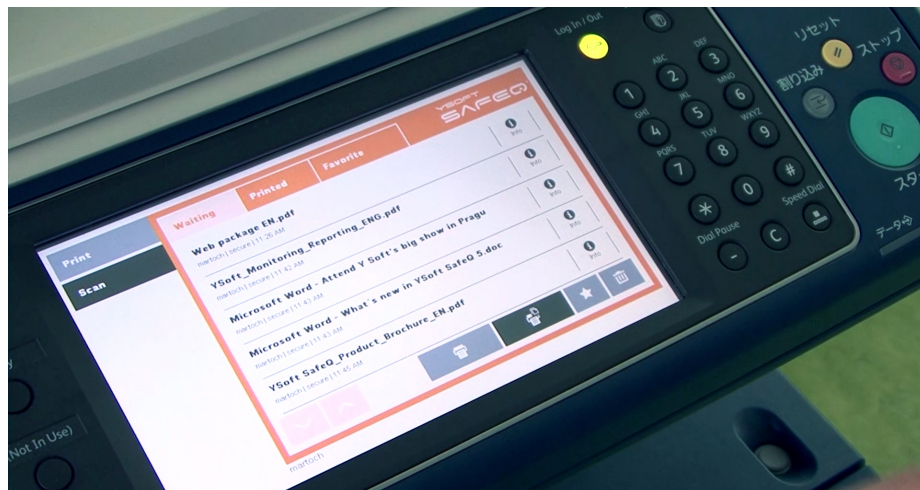


Figure 3.3: Fuji Xerox embedded terminal graphical user interface (web-based)

3.2.2 SafeQ Terminal Application

SafeQ terminal application (SQTA) is a unified interface for accessing SafeQ functions at the MFP locations. Its main goal is to provide MFP users with intuitive and unified interface regardless of the MFP which they are operating. It runs as a native application in MFP. Currently SQTA consists of 4 main parts:

- Authentication
- Print application
- Scan application
- Billing codes

Not every vendor allows API for every part. For example, some vendors only allow print API, other can allow print and scan API or whole API. Terminal Professional is specific case, it operates as addition to the MFP but provides almost the same functions as embedded.

Authentication

SQTA supports severe authentication options, depending on the capabilities of the MFP:

- Authentication by card
- Authentication by username/password
- Authentication by PIN
- Authentication by a combination (card and username/password, card or username/password, card and PIN, card or PIN)

The authentication process usually occurs as user swiping their ID card or entering credentials. After that, the data is submitted to SafeQ server which decides whether the user is in internal or LDAP user database. SafeQ server also checks the user's rights in access control lists, such as whether the user has the right to use that particular MFP, and if so, which features user can use. Afterwards, the SafeQ server sends back authorization to the MFP to let the user use it according to the authorized rights and the capabilities of the MFP.

Print Application

Users can use the terminal interface to manage their print jobs at the MFP. The user can see details about each job, including a preview or detailed information such as the number of the job's pages. Details are available both for jobs waiting to be printed and for jobs that are available for reprinting. Jobs are sorted into folders labeled "Printed", "Waiting", and "Favorite". Users can easily find the specific print job they need and select jobs to print or to delete. Users can also mark certain jobs as favorites that will always be available and ready to print.

Scan Application

SQTA allows users to use scan workflows — customizable sets of scan settings that enable scans to be automatically sent to destinations such as an email inbox, a home folder, document storage, or an external script. If the workflow has been set up to allow it, the user can change scanning options such as simplex or duplex, resolution, and color mode, as well as workflow parameters — for example, the email address the scanned document will be sent to.

Scanning from an embedded terminal is almost the same as with a hardware terminal. The user authenticates and the MFP unlocks. The user selects the desired scan workflow from the menu displayed on the embedded terminal interface and makes the scan.

Billing Codes

Billing codes enable prints, copies, and scans to be billed and accounted per project. This is especially useful when employees work on several projects at the same time and per-project statistics and accounting are needed.

To apply a billing code to copies or scans, after users authenticate at the MFP, they select the billing code they want to use from a list displayed in the embedded terminal interface. That billing code will be used for all copies and scans the user makes in the current session and future sessions, until the user selects a different billing code. The selected billing code is displayed on the terminal main screen so that the user knows what billing code he/she is currently using.

Behavior of billing codes for printing is different. To apply a billing code to a print job, the user selects the billing code at their workstation (desktop PC) from a pop-up that appears in the SafeQ Client interface when the user sends a job to print.

3.3 Company Organization

Research and Development (R&D) department distributes its operation into small teams. Every development team has five to six members and one team leader who's in charge. Whole product is divided into subsystems which includes modules. One engineering team is responsible for one subsystem, which means that every team is responsible for specific amount of modules. They have, so to speak, freedom in their job organization although their customer is not manager but product owner. Product owner is usually a member of product management team, which acts as an “ideal customer”. That means he takes responsibility to answer every question of the developer. The company is very dynamic - due to this fact they tend to respond as soon as possible to requested changes by customers.

3.3.1 Development Process

Based on interviews with team leaders and solution architects I have found out that Y Soft uses mixture of Agile Unified Process (AUP) and Scrum as software development process. AUP is a streamlined approach to software development based on IBM's Rational Unified Process (RUP) [25]. Figure 3.4 depicts the lifecycle of the AUP. The Agile UP lifecycle is serial in the large, iterative in the small, delivering incremental releases over time. Agile UP disciplines are performed in an iterative manner, defining the activities which development team members perform to build, validate, and deliver working software which meets the needs of their stakeholders. The disciplines are:

- Model — the goal of this discipline is to understand the business of the organization, the problem domain being addressed by the project, and to identify a viable solution to address the problem domain
- Implementation — transformation of model(s) into executable code and performing a basic level of testing, in particular unit testing
- Test — perform an objective evaluation to ensure quality. This includes finding defects, validating that the system works as designed, and verifying that the requirements are met
- Deployment — plan for the delivery of the system and the execution of the plan to make the system available to end users
- Configuration Management — managing access to project artifacts. This includes not only tracking artifact versions over time but also controlling and managing changes to them
- Project Management — direction of the activities that takes place on the project. This includes managing risks, directing people (assigning tasks, tracking progress, etc.), and coordinating with people and systems outside the scope of the project to be sure that it is delivered on time and within budget
- Environment — support of the rest of the effort by ensuring that the proper process, guidance (standards and guidelines), and tools (hardware, software, etc.) are available for the team as needed

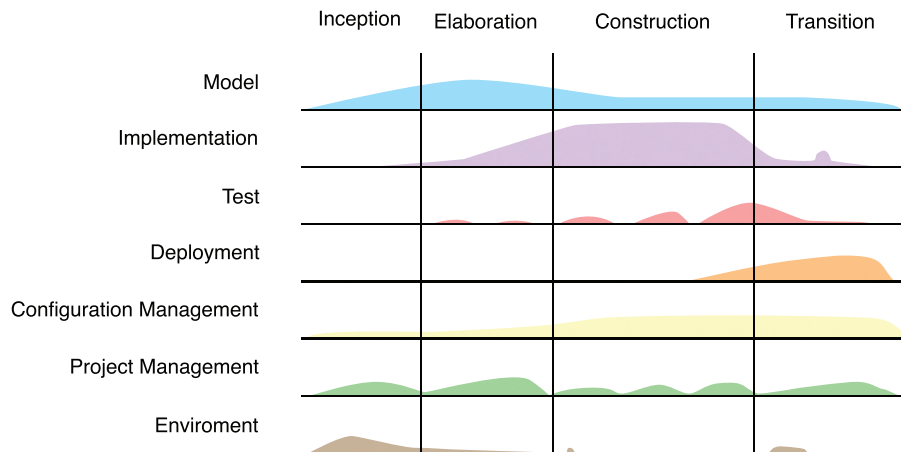


Figure 3.4: Phases and disciplines of AUP lifecycle — The figure is capturing effort of development team spent on specific disciplines in various phases. Author: *Scott W. Ambler [25]*

Scrum is a lightweight development framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value. The Scrum framework consists of scrum teams and their associated roles, events, artifacts, and rules. The scrum team consists of a product owner, the development team, and a scrum master. Scrum teams are self-organizing and cross-functional. Self-organizing teams choose how best to accomplish their work, rather than being directed by

others outside the team. The product owner is responsible for maximizing the value of the product and the work of the development team. The scrum master is responsible for ensuring scrum is understood and enacted. The heart of Scrum is a Sprint, a time-box of one month or less during which a “Done”, usable, and potentially releasable product increment is created [26].

Whole development in company is segmented into “epics”. Epic is a work unit which can be prioritized. Epic has four phases which are adopted from AUP — inception, elaboration, construction, and transition. All epics are stored in “backlog”. Priorities of epics in backlog are determined by entity called “Product governance”. Product governance consists of CEO, CTO, R&D management and VP of sales.

Epic comes into existence as an idea, usually as a sales request. Idea is something that cannot be prioritized or assigned. Sometimes idea transforms into epic and again back into idea to mark that it is not meant to be developed at that moment. When the idea enters inception phase, the product managers and solution architects are responsible for proper definition of epic task, its assignment, and the explanation why it has to be done. Inception phase also requires investigating which subsystems will be affected by this epic. Afterwards it is possible to determine who will the epic be assigned to.

In elaboration phase the epic is precisely analyzed to understand from which development activities it will be comprised. Usually Work Breakdown Structure (WBS) is used for this. WBS is useful technique that is used in project planning and managing. Basically, you divide project into separated non-overlapping parts, which need to be done. These parts are afterwards divided into smaller parts until you can reasonably estimate them. The goal is to cover all aspects of project which need to be done, regardless of their time sequence [27]. The result of elaboration phase is estimated time spent on epic — count of sprints. After this phase there should be check whether this estimate is correct.

Epic is being implemented in construction phase. Sometimes the epic is so extensive that it’s implemented by parts which are included in releases. Those releases are called fix versions.

When epic enters transition phase, it’s ready to be released. Firstly, it’s released under early access license, so feedback can be collected and epic may be debugged. The lifecycle of epic ends when it is published as a cumulative update.

Basic development unit in Y Soft is sprint that lasts three weeks. Those sprints are being recorded in a tool called Jira². Typically, the Jira serves as a tracker for teams and their sprint goals — information included in Jira is result from elaboration phase. Additionally, service-level agreement (SLA) bugs falls into sprint goals. These SLA bugs are usually issues reported by customer. The job of a release manager is to proceed all SLA bugs and assign them to sprint goals. At the end of the sprint (third week) demo takes place as a showcase of what has been done. Moreover, evaluations and retrospectives are held at the end of the sprint.

3.4 Current UX Maturity Level

Before my arrival to company, there have been introduced some practices that might be considered as UX practices — for instance user stories, product canvases, and product roadmaps³. These agile product management tools are designed to help product managers,

²for more info visit <<https://www.atlassian.com/software/jira>>

³If you are interested how any of these tools works, visit <<http://www.romanpichler.com/tools>>

product owners, or UX designers to create products. User stories were primarily used as a list of product functionality. Visual designs and prototypes of user interfaces have been delivered by external agencies.

By guidelines of Vetrov's Maturity model one can say Y Soft is at operational maturity level — developers are on their own or designers are outsourced. This means design quality is random (design chaos). The company began following a systematic design approach. This is not because of problems in consumer's perception of product in the form of negative feedback, or shrinking customer base, or any kind of criticism. It is done because Y Soft wants to be one step ahead of the competition. At one of the regular meetings I have received feedback from colleagues that UX in Y Soft should reach at least level where UX is critical and executives are actively involved.

Due to these facts I have concluded that it is possible to deliver better UX of existing products and raise UX maturity in Y Soft. Primary goals are — identification of user base, identification of usability issues of existing products, fixing those issues, and raising awareness of UX in Y Soft.

3.5 Observed Hypotheses

In this section I will describe most important hypotheses which I have come across through my observation of development process in company and through interviews with the key stakeholders. Besides the description I will provide proposals for specific hypotheses.

Employees who act in development process don't know the end users

Because Y Soft operates as B2B company, it is almost impossible to get end user feedback. Outermost feedback boundary is the partner network or organizations which directly contact Customer Support Services department with a specific request for feature or fix. But still there is a great number of assumptions about user behavior in the minds of employees. The only sensibly reachable user segment was student segment. My proposal is to introduce personas.

Only usability flaws are known via customer feedback

Most of the time customers are not end users. Usually, customers are mostly decision makers from management who decide whether they purchase SafeQ. After some research, I have learned that there wasn't any user testing performed. My proposal is to conduct user tests with few users in every iteration. I will clarify this proposal in next chapter.

Product managers are important from the business point of view, but the importance of user centered design is left behind

One of the best practice would be to set UX practitioner as a part of the customer or product owner team [28].

There is no SafeQ copy application

Current solution relies on native printer copy application. I strongly recommend implementation of own copy application — there might be serious UX issues with native copy application.

Chapter 4

Implementation of UX Principles

I have carried out three user experience methods. This chapter will be describing the implementation of those methods — what tools, techniques, or frameworks did I use and why. The methods are bound to hypotheses from previous chapter.

4.1 Personas

I have used research method called personas to understand the end users of SafeQ. I have decided to apply persona creation process based on lifecycle framework mentioned in *The Essential Persona Lifecycle*. The reason why I have decided for this framework is that the framework emits from Alan Cooper's *The Inmates Are Running the Asylum: Why High Tech products Drive Us Crazy and How to Restore the Sanity*, the creator of personas.

If we go by the book, it says that personas can be distinguished whether they are data driven or ad hoc. In this section I will describe why have I decided for ad hoc personas and process of their creation. Ad hoc personas are much cheaper, easier to create, and faster to produce than data driven personas. Besides, the ad hoc personas are great for experiencing the first-hand use of personas and can lead to data driven personas. Still, ad hoc personas have drawbacks. The biggest disadvantage is that the ad hoc personas are based only on assumptions. This needs to be taken into consideration in latter phases of persona lifecycle. The risk of assumption-based personas comes when the team forgets or ignores the fact that the information contained in the personas is based merely on assumptions and begins to treat it like data.

4.1.1 The Five Phases of the Persona Lifecycle

The persona lifecycle is a metaphoric framework that breaks the persona process into phases similar to those of human procreation and development. As shown in figure 4.1, the five phases bring structure to the potentially complicated process of persona creation.

- **Family planning** — figure out what problems needs to be solved and what data is available.
- **Conception and Gestation** — organize assumptions, turn data into information and information into personas.
- **Birth and Maturation** — create a persona campaign and introduce the personas to your organization.

1. Identify participants and schedule the workshop
2. Clarify business, brand, and user experience goals.
3. Identify current language used to describe categories of users and customers.
4. Complete the assumption-gathering sticky note exercises.
5. Assimilate assumptions.
6. Identify skeletons.
7. Prioritize skeletons.

Many deliverables emerged after these two workshops. We agreed upon persona goals from UX, brand, and business view. Because we defined goals first, we have been conscious about them through the rest of the workshops. The goals are:

- **UX goal** — we want to create a set of ad hoc personas to help recruit participants for usability testing.
- **Brand goal** — solve the incompleteness of accusative case. Ask not only what is the problem, but also who's bothered by this problem.
- **Business goals** — better communication when developing products. Improve quality of requests by identifying the users with personas.

Sticky note exercise was about writing a story on a sticky note — person and a situation or problem (could be written from user point of view). Next, we had to assimilate written assumptions by creating user categories. We've looked for patterns and afterward reclustered the sticky notes to match user needs, not our defined user categories. Figure 4.2 shows the result. These sticky notes were then used as a foundation for persona skeletons. But first, they needed to be briefly reviewed. Many of them merged together and few of them were removed. After the reviewing, we had eleven skeletons so far.

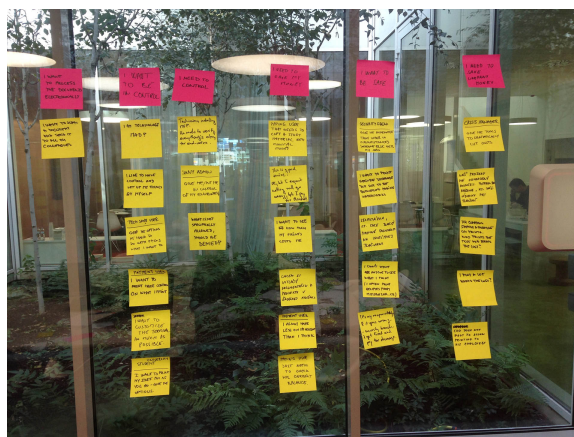


Figure 4.2: Sticky notes exercise after reclustered and reviewing — pink sticky notes express needs of the users and yellow sticky notes capture person with some activity in a situation.

Persona skeleton	Score
I need to save company money	73
I want to be safe	72
I need to save my money	77
I need to control	61
I want to be in control	34
I want to save time	77
I want to sell (make money)	28
I want to print/scan/copy	55
I need to print/scan/copy	124
I need help with new function	42
I want things to stay simple	57

Table 4.1: Persona skeletons with their priority score

The prioritization process came as a last step. The prioritization was done through personal perceived importance (frequency of use, size of market, strategic importance, etc.). Of course, every member of persona team had his own opinion about prioritization, but disagreements are fine. They bring out the issues on the surface. Personas should help to solve them. Prioritization was done by assigning points, but two different skeletons couldn't have the same amount of points unless it was 0. Result of prioritization of persona skeletons is shown in table 4.1.

The most important result of whole phase was creating the foundation document. The foundation document contains the information that will motivate and justify design decisions and generate scenarios that will appear in feature specifications, vision documents, storyboards, and so forth. Foundation documents contain the complete definition of a given persona. The created ad hoc persona foundation document includes following¹:

- Photo
- Persona name, usually a descriptive name such as “Ellen Everyday”
- Priority score
- Identifying quote for quick communication of the key goals or needs with respect to the product
- Meet-the-persona narrative
- Questions in persona name's which help to capture key questions and concerns that the persona has with respect to your product
- “Oh, by the way ...” statements, which allow recasting the benefits or new features that will resonate for the persona
- Data sources used for personas

Incorporating narratives and photos enriches skeletons into personas that are realistic and engaging. This part of persona creation does take creativity and inspiration, but

¹data driven persona foundation documents usually differ

personas need context and background to feel real. Illustrating personas with photos is critical. They help team believe that personas describes a single person. *The Essential Persona Lifecycle* recommends setting up own photo shoot of local people, but because this is time-consuming process I have decided to use free photos under the creative commons license.

We cooperated to create eleven ad hoc personas in total. I have implemented them as an HTML documents to serve as a central repository for all of persona data, descriptions, and materials. I have used CSS media queries so that the personas will be adapted to paper size when printing and adapted to screen-width while browsing them with mobile device. Reviewed skeletons, whole prioritization scoreboard, and HTML foundation document can be found on attached DVD. Once personas are complete, substantive, and stable, they need to actively participate in the design and development process.

Persona Birth and Maturation

This phase marks the transition from persona creation to persona use. Personas are fully formed and will now begin to develop in the minds of product team. The birth and maturation phase consists of three distinct activities [11] — preparation for birth and beyond, introducing the personas (birth), and educating and maintaining focus on personas (maturation). I have tried to assign an ownership of each persona to a single team member, but with no result.

The key part of the preparation phase is to create communication strategy to help communicate the basic value of personas to a possibly less than interested audience. Goal during birth is to introduce the personas in order for them to help colleagues make important decisions such as recruiting participants for user sessions (one of the goals). If personas will achieve success, this should lead to data gathering for data driven personas. Firstly, I have launched personas to only small circle of colleagues. Introduction of personas to whole company has been done while recruiting participants for first user testing as a hyperlink to specific persona we were looking for. To maintain focus on personas, I have stored them into internal wiki pages so that anybody can get access to them.

Adulthood

Adulthood is the phase of the persona lifecycle when the personas were put to use. As mentioned before in my case, personas were mainly used for decision making while planning user tests on brainstorming meetings. Other than that it was used as a communication tool for recruiting test participants. The result of assumption gathering exercise was also very important to settle how colleagues think the end users look like. This helped me to make some picture how to make scenarios for tests².

During this phase there were moments, for example while testing an internal people where participants were saying stuff that I wanted to incorporate into personas — these quotes and statements have been therefore added into foundation documents.

Lifetime Achievement and Retirement

The final persona lifecycle phase is about measurement, regaining control of the persona effort as a whole, and preparing for the future. Two primary tasks should be performed:

²Scenarios can be long descriptions of specific tasks your personas undertake to achieve a goal or short snippets describing activities related to a specific tool [11]

- Measure the lifetime achievement of your personas (their value)
- Manage the organization's transition to a new project with regard to user-centered design (UCD) and target audiences, which will involve reusing, retiring, or in some way reincarnating your personas

The results of this phase will be further evaluated in next chapter.

4.2 User Testing

In this thesis I have used various methods of user testing. Regardless of user tests' conduction, they always follow a similar testing protocol:

1. Identify potential users (ideally by research, see previous section)
2. Recruit potential users
3. Create test guidelines
4. Schedule test sessions with potential users
5. Administer the test
6. Analyze the results

The main testing events were simulations of lab research. Besides those tests, I have conducted hallway and guerrilla user tests. The guerrilla user testing took place at the Faculty of Business and Management of Brno University of Technology. I have approached various students at the campus to see how usable my prototype was. I have offered biscuits as an incentive. The sessions have proceeded as following — small introduction why I need attention of approached participants, what is the prototype representing, administration of the tasks, and additional questions about the interface of the prototype. I have applied the similar approach to hallway tests. The difference is that I haven't approached particular participants, but grabbed random passing colleague in Y Soft's relax hall. This time no incentive have been offered and the goal was the same, validate the usability of the prototype.

4.2.1 Simulation of Lab Research

Because Y Soft doesn't have usability lab, I had to improvise. My approach was to book two meeting rooms. In the first room, there was a seated participant with mentor and in the second there was a computer streaming action happening in the first room. Due to this distribution, test participant wasn't nervous about other people behind his back watching every step he takes but still, colleagues could see. There were two cameras — the first was shooting participant's hands and printer's terminal, the second was filming participant and mentor. The purpose of the second camera was to capture emotions of the participant and mistakes of mentor. The first camera was also streaming to WebEx³ session for colleagues in the second room, or colleagues outside the Brno headquarters.

³Cisco WebEx is a collaboration web conferencing tool <<http://www.webex.com/>>



Figure 4.3: Meeting rooms prepared for user testing. First image shows usability test with MFP and test participant. Second image captures MFP with attached tablet running the web-based prototype, two cameras, and test notebook.

Identification of potential users was done with the help of personas. At this point we realized how important the personas were to help us recruit the participants. We managed to recruit participants in just a few days thanks to the personas. The finite number of participants was five. Why five users? Nielsen says that the best results come from testing no more than 5 users and running as many small tests as you can afford [18]. The main reason is that it is better to distribute the budget for user testing across many small tests instead of blowing everything on a single, elaborate study. The real goal of usability engineering is to improve the design and not just to document its weaknesses.

First Usability Test

The goals of the first usability test were to understand user needs and find severe usability issues:

- What do users conceive and think about using the product
- How easily and successfully can users navigate
- How easily can users use product interface based on their previous experiences
- Difficulty of tasks from user's point of view — which functions of the product are “walk up and use” and which require some kind of help or documentation

Through this procedure we were able to form hypotheses about the product which we wanted to confirm or disprove. I will mention just a few, because the tasks were based on them:

- Users have a big problem switching from native to SafeQ menu and vice versa. This may happen when MFP vendor provides API only for printing and scanning, but lefts out providing API for copying
- Some terms might be unclear about what do they mean (e.g. billing codes)
- Scanning a document is a difficult action

Resolving the tasks was not an easy part. One must consider how to confirm or disprove the hypotheses with planning the specific case in right order. For example, we agreed upon testing the MFP functions in this order - scan, copy, print. With this, we were able to monitor how easily users navigate through printers native and SafeQ menu. When we had something written down, we moved on to picking out the personas. At this point I have had found out that this order wasn't suitable.

“Better flow for planning a user test is to begin with hypotheses, then select personas and as last step devise the specific tasks.”

Second Usability Test

Second usability test with lab simulation was meant to see whether the improvements incorporated into prototype have proven as useful. Its purpose was also to get some new user data because the new prototype has been planned for future development. Again, I have set up a meeting with stakeholders to agree upon test protocol. To see whether we have improved, we decided to keep the same tasks with same personas for second usability test. The only difference was that we were not testing the SafeQ in embedded MFP interface, but generated HTML prototype running on tablet that was attached to MFP.

Recruiting the Participants

I have used snowball sampling for recruiting participants. Snowball sampling, by some authors called chain referral sampling, is a method that has been widely used in qualitative sociological research. By definition, a chain referral sample, or snowball sample, is created through a series of referrals that are made within a circle of people who know one another [29]. I stored all received contacts into internal wiki to create a participant panel. This panel will be used to recruit participants in the future. To verify whether the contacted participants are representing the personas I have asked them few questions over phone. This is called participant screening. Participant screening is where you sift through all the possible candidates to identify people who are truly suitable [30]. Again, I have used persona foundation document to identify whether the candidates match personas.

Test Protocol

Before conducting tests, I have sat with participants and went through all the instructions which were written on a script. This script can be found on attached DVD. Firstly, I have explained that the session was not about testing the participant but about testing the product. This was said to calm the participant. I have asked a participant to say out loud everything he was going to do or was thinking about when interacting with MFP. After initial instructions I have asked participants to sign non-disclosure agreement which included agreement about recording and incentive (I have managed to receive financial expense approval to gain credibility of testing and to motivate users). After signing the document I have started recording — this made some participants feel insecure. That is why I have asked them few questions before diving right into tasks, such as computer or MFP usage. It has also helped me to realize frequency of MFP use by participant. While they were speaking I have also asked for participants hobbies — the responses have helped me to edit narrative of the personas and participants calmed down while speaking about

familiar topic. Script for user testing can be found on attached DVD. I have set up the script based on recommendations and example script in Steve Krug's *Don't Make Me Think!* [31].

Afterwards, we began with specific tasks. While testing I let participants get stuck to see where the navigation problems were. After finishing all tasks, I have led them through all parts of SafeQ to ask about incomprehensible UI elements, icons, etc. At the end of this part I have told them that I stopped recording — almost everyone started talking about the SafeQ after the stress from camera waned. This is considered as the most productive part of testing, hearing the most important comments about your product. At the end of the session I have asked every participant to fill simple questionnaire which included questions about difficulty of operations and recommendations about the product.

UX Metrics

A metric is a way of measuring or evaluating a particular phenomenon or thing. One can say something is longer, taller, or faster because we are able to measure or quantify some attribute of it, such as distance, height, or speed. User experience metrics show whether you are actually improving the user experience from one product to the next [32]. There is a good deal of metrics that can be measured while testing.

I have chosen following metrics — task success, time on task, measuring errors, and likes, dislikes and recommendations. One of the best metrics to evaluate navigation is task success. By giving participants tasks to find key pieces of information, one can tell how well the navigation and information architecture works for them. Tasks should touch on all the different areas of the product [32]. Because SafeQ is a product used on a frequent or semifrequent basis, it needs to be both easy to use and highly efficient. Most of us have very little time or patience for products that are difficult and inefficient to use. Recommended metric to evaluate the frequent use of the product is task time. Measuring the amount of time required to complete a set of tasks will reveal the effort involved. For most products, the faster the completion time, the better. Measuring errors is suitable when an error will result in task failure, data loss, or in significant costs to your organization or the end user — such as undesirably deleting all waiting print jobs or undesirably printing the document with a hundred pages in duplex mode instead of simplex mode.

Task Success

The most common usability metric is task success, which can be calculated for practically any usability study that includes tasks. To measure task success, each task that users are asked to perform must have a clear end state or goal, such as purchasing a product, finding the answer to a specific question, or completing an online application form. Task success can be divided into — binary success or into levels of success [32]. Level of success can also be examined in terms of the user experience. Some tasks are completed without any difficulty, whereas others are completed with minor or major problems along the way. It's important to distinguish between these different experiences. A four-point scoring method can be used for each task:

- **1** = No problem. The user completed the task successfully without any difficulty or inefficiency.
- **2** = Minor problem. The user completed the task successfully but took a slight detour. He made one or two small mistakes but recovered quickly and was successful.

- **3** = Major problem. The user completed the task successfully but had major problems. He struggled and took a major detour in his eventual successful completion of the task.
- **4** = Failure/gave up. The user provided the wrong answer or gave up before completing the task or the moderator moved on to the next task before successful completion.

Time on Task

Time on task is a good way to measure the efficiency of a product. In most situations, the faster a user can complete a task, the better the experience ⁴. Time on task is particularly important for products where tasks are performed repeatedly by the user [32]. Time on task is simply the time elapsed between the start of a task and the end of a task, usually expressed in minutes and seconds.

Measuring Errors

Some user experience professionals believe errors and usability issues are essentially the same thing. Although they are certainly related, they are actually quite different. A usability issue is the underlying cause of a problem, whereas one or more errors are a possible outcome of an issue. Essentially, errors are incorrect actions that may lead to task failure.

Errors are a useful way of evaluating user performance. Generally an error is an action that causes the user to stray from the path to successful completion. Sometimes failing to take an action can be an error. Errors can be based on different types of actions by the user, such as — entering incorrect data into a form field, making the wrong choice in a menu, taking an incorrect sequence of actions, or failing to take a key action. The most common way of organizing error data is by task. Simply recording the number of errors for each task and each user.

Likes, Dislikes and Recommendations

Participants provide what they liked most about the site, what they liked least about the site, and recommendations for improving the product.

Confidence Interval

A confidence interval is an estimate of a range of values that includes the true population value for a statistic, such as a mean. Confidence intervals reflect how accurate estimates of measures such as task times, task success rates, and subjective ratings actually are [32]. Constructing confidence interval around that mean will show the range of values that will reasonably certainly include the true population mean. There are three variables that determine the confidence interval for a mean — the sample size n , or the number of values in the sample, the standard deviation σ of the sample data, and the alpha level α expressing the error that one is willing to accept. The confidence interval is then calculated using following formula:

$$confidence = mean \pm \alpha * \frac{\sigma}{\sqrt{n}} \quad (4.1)$$

⁴there are some exceptions, for example games, where the user doesn't want to finish it too quickly

4.3 Iterative Prototyping

The most important benefit of prototyping is that it gives something to evaluate before even committing resources to build the real thing. Because prototyping provides an early version of the system that can be constructed much faster and is less expensive, something to stand instead of the real system to evaluate and inform refinement of the design, it has become a principal technique of the iterative lifecycle. I have applied this iterative attitude by tying prototypes of various fidelity with evaluation using user testing.

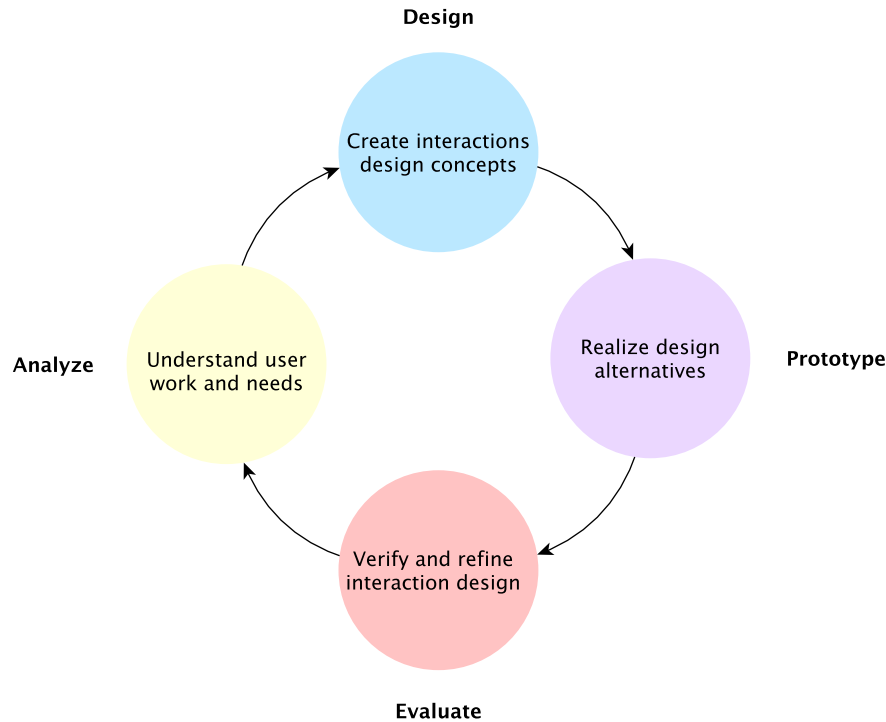


Figure 4.4: Although prototyping is a kind of implementation, design and prototyping in practice often overlap and occur simultaneously. A prototype in that sense is a design representation.

First usability test was a starting point. After the test I have summarized the most significant usability issues together with participants' comments, and other colleagues' notes. This results have served as a subject to create prototype. To include stakeholders into the process of prototype creation I have decided to set up prototyping workshops (I have used Design Studio technique, described in section 4.4.3). At these workshops we prototyped on paper to reach agreement how to solve the issues that emerged at user testing in a reasonable time. After the first session, we have agreed upon creating the most interactive prototype based on the first paper prototypes that will not take into account the limitations of individual MFP vendors. This means that the prototype should consider touch gestures, animations, etc. Of course, these features cannot be supported on resistive touch screens — because they are single-finger only, the palette of gestures cannot include the multitouch gesture, also sliders might not work so well. This interactive prototype can be ran on the external terminal professional. To consider these limitations, we will reduce features of

the prototype in the future to adapt this prototype to the specific MFP. We gradually ran through parts of SafeQ mentioned in section 3.2.2. We have started with print application, then with authenticate screens, billing codes, and at last moved on to the scan application.

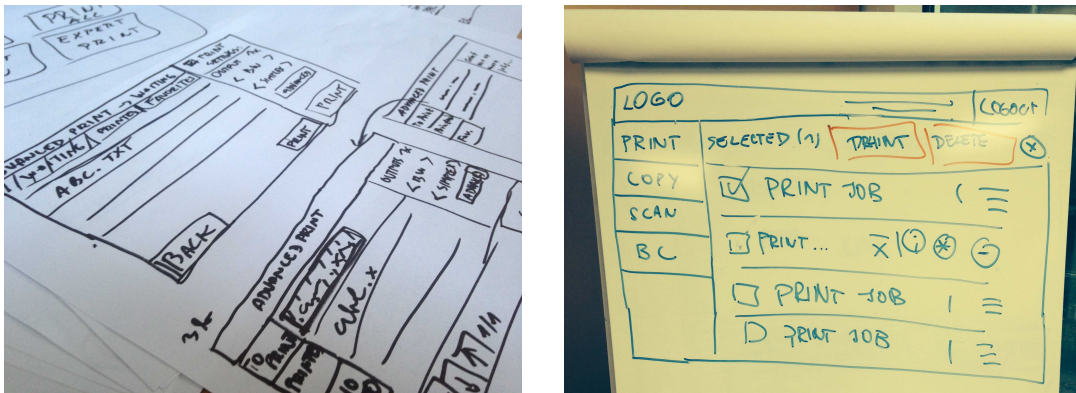


Figure 4.5: First image shows paper prototypes from prototyping workshop for print application. Second image captures consensus at the end of the workshop — refined prototype drawn on the board.

Based on first usability results, I have incorporated feedback message dialogs in print application to notify users that the operation is over. I have also changed mechanism of favorites and printed jobs due to the requirements that resulted from first usability test. Next, I have relocated the buttons (except the print button) from bottom line to the context menu that is being displayed when needed — after selecting at least one job. A new feature called “finishing options” has been incorporated into print job information screen, where the user can change properties of a print job such as color mode, duplex mode, copy count, page range, etc. Another addition was a checkbox near print job, which indicates that user has to select print jobs before tapping the print button. Print all has been removed — you can select all print jobs in the context menu and then tap print button with variable labels. This means that user has feedback how many jobs he has selected by updating numbers next to a print label. Similar principle works when adding print jobs to favorites. A number next to the favorites tab label indicates count of favorites. The user has an immediate overview how many favorite jobs there are.

To speed up the authentication process we have also modified authentication screen in a way that the keyboard adapts to the authentication method. Authentication by PIN screen contains only text input with validation message and software keypad. Username and password authentication includes software keyboard which allows user to proceed through text inputs. When authentication method consists of two authentication steps, such as username with password and card, user is required to swipe card first. This proposal should eliminate frustration of users when they fill their credentials first and subsequently swipe their cards finding that the card might be broken, or they even forget their cards at their work desks. There were also few similar comments from first usability test that logout button should be incorporated in SafeQ application.

Because some vendors don't support the API for copy applications, we have decided to drop out copy application from prototype. My proposal was to preserve copy application as a tab in SafeQ application. This tab should contain short tutorial or illustration which will tell users that copying has to be performed in native interface of the MFP. This should reduce the feeling of being lost in application.

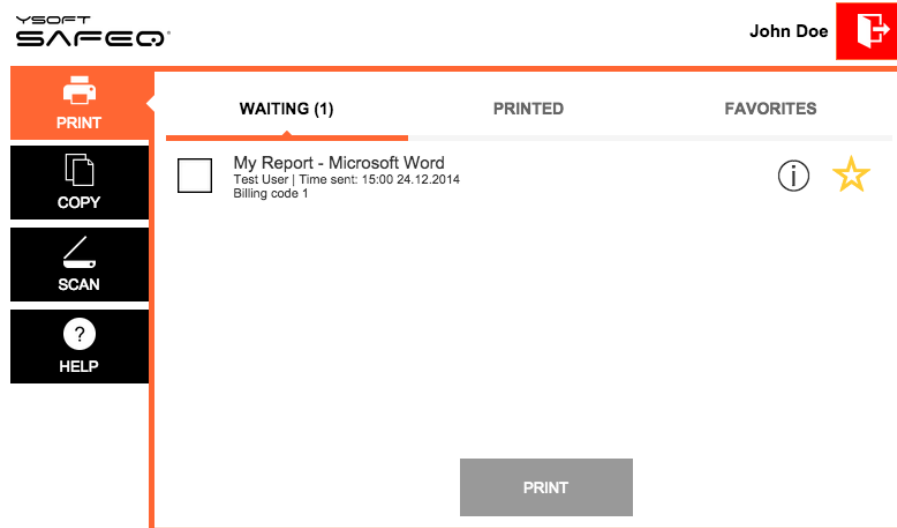


Figure 4.6: Axure prototype of print application with one print job. You can print, delete, add print job to favorites, see print job information, or set print properties for single print job.

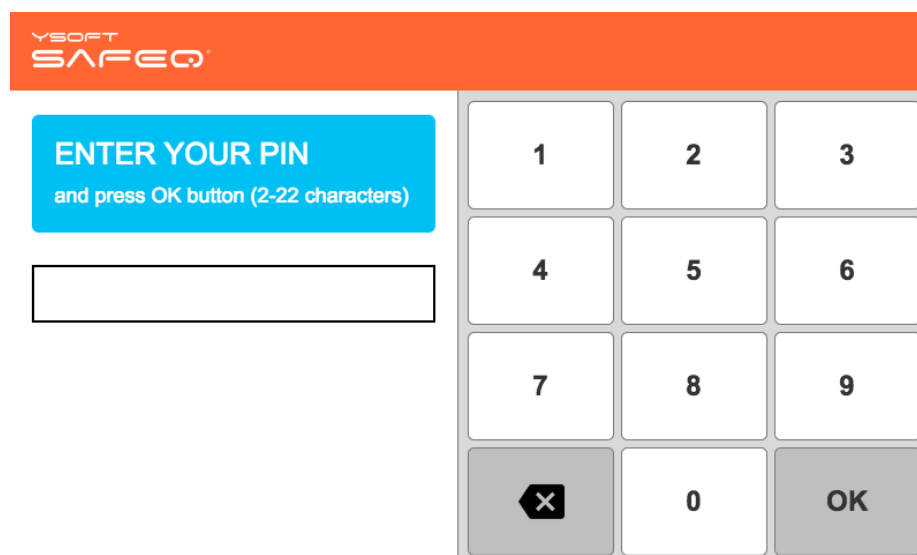


Figure 4.7: Authentication screen with keypad for PIN entering with informative label. This should speed up authentication process.

The biggest problem of billing codes is that only those who use them understand their meaning. Typically, billing codes are used by lawyers or architects which need to bill printing costs to individual projects. The first testing showed issues with selecting billing code — misunderstood feedback and navigation through tree structure. I have redesigned the tree structure into column view, added breadcrumb navigation, and created new selecting mechanism. I have also changed when will be user asked to select billing code — he will be now asked to select billing code when selecting copying or scanning, not right after authentication — user might want to just print and billing codes do not apply to printing,

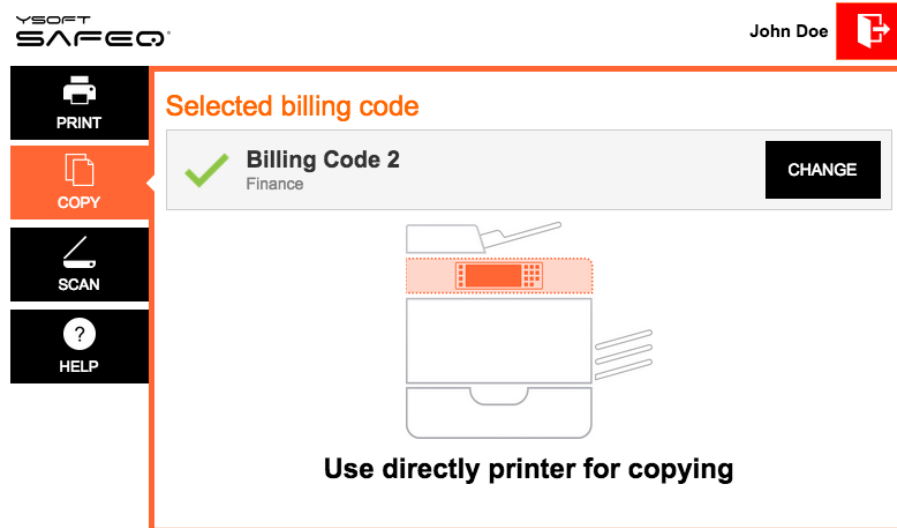


Figure 4.8: The copy tab is preserved but the content is only illustration with label which tells user to switch into MFP native interface. Users should not be stuck in SafeQ anymore.

single print jobs can have different billing codes assigned.

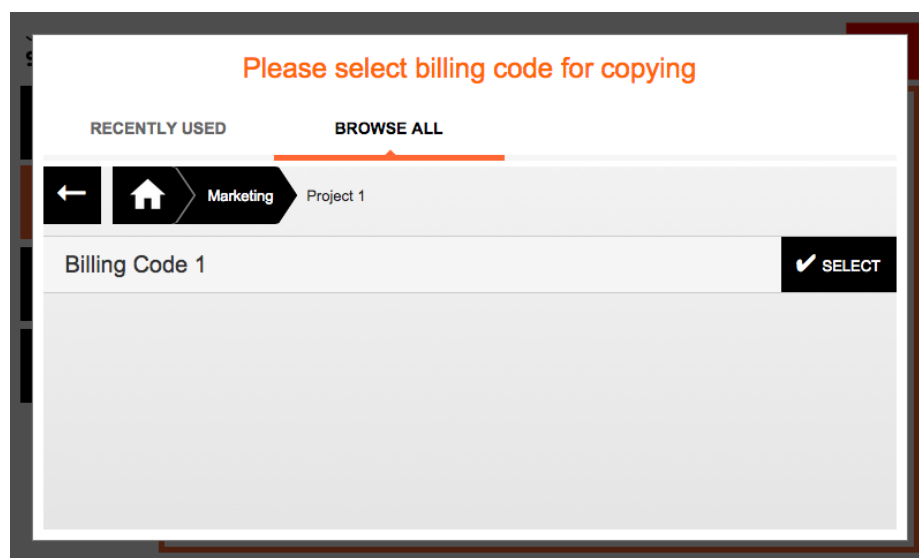


Figure 4.9: Column structure of billing codes with breadcrumb navigation. After selecting the billing code you will be redirected to the selected application — scan or copy.

Scan application has been modified only slightly. I have relocated buttons so that scan layout matches to print application. I count on the fact that users will start in print application right after authentication — users will see from the beginning that scan is reachable from SafeQ. This differs from embedded terminals, where users are not informed that scanning and printing is being done with SafeQ.

During the first usability test users sometime became stuck. At this situation I asked a question whether they would like an additional help function. Almost every one answered yes. I have designed help application as two-level structure. First level is a set of tiles divided

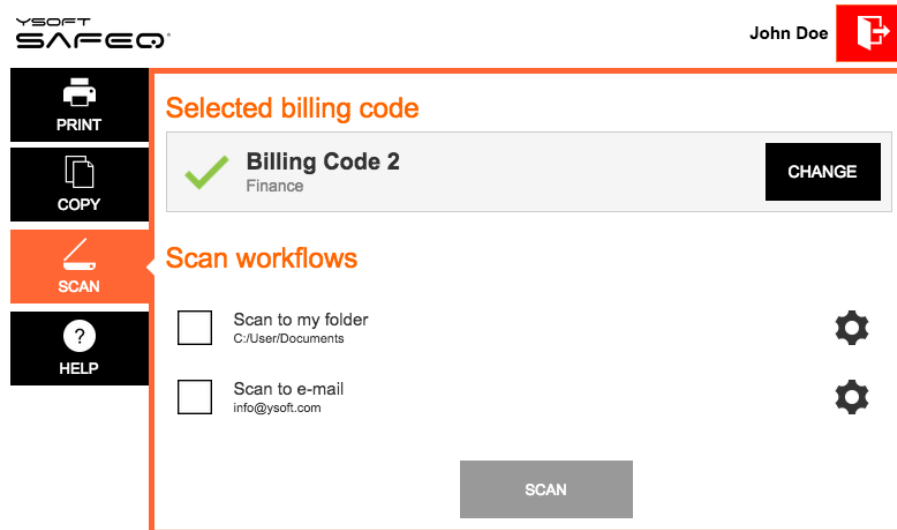


Figure 4.10: Scan application with few workflows. Billing code is shown only in relative context. Companies that do not use billing codes will lack selected billing code section.

by functionality — scanning, printing, copying, printer troubleshooting, etc. Second level of help is represented by accordion structure filled with frequently asked questions. Creation of the content is something that requires too much effort. I have included only the structure of help into prototype to see whether the users would like it.



Figure 4.11: Second level of help, the accordion structure with frequently asked questions. Meanwhile, the content is just a placeholder.

I have decided to create high-fidelity prototypes to incorporate all the interaction features. Also, high-fidelity prototype can show better results from future user tests. For this, I have used tool called Axure RP mentioned in section 2.3.3. This tool could meet the requirements and I have also used it for prototyping in the past. I found the Axure publish function to web very useful due to the possibility of quick deployment for user testing.

Axure also supports a variety of animations and transition effects. Most powerful tool from Axure toolbox that has been used for this thesis is dynamic panel. The dynamic panel widget is a container that holds other widgets in layers or states. The panel can be hidden, shown, and moved. And the currently visible state can be set dynamically. An example of the dynamic panel can be touch keyboard. The keyboard has more states — lower case characters, pressed shift, caps lock, numeric, and symbol.

Another useful Axure feature were global variables. This helped me to build complex conditions for authentication or billing code selection. When creating the print application page with more jobs I have encountered that global variables don't include lists or objects. This ruled out the manipulation with more print jobs — I could not find a sensible way how to implement this mechanism. I have conducted guerrilla and hallway test to validate the icons, illustrations and usability direction of the prototype.

4.4 Raising Awareness of UX Activities

In this part I will describe activities which I have executed to raise awareness of user experience in Y Soft. The reason of this internal promotion is to get good relationships with others in the organization, build credibility, get integrated, and showcase the activities.

4.4.1 Buzz Generators

I have created several posters as buzz generators that introduced user testing and raised awareness that something is happening. Posters included funny pictures to get people talking and interested. Although their purpose is not to convey detailed information about user testing, rather their purpose is to generate excitement and interest in the idea of user testing. Buzz generators should foster a sense of anticipation and a bit of mystery.



Figure 4.12: Buzz generating posters for first usability test

This has proved useful as Y Soft has never conducted any kind of user testing before. The posters shown in figure 4.12 really helped and I received feedback from many colleagues that they were notified about the upcoming user test.

4.4.2 Technology Hour

Part of a company culture is event called Technology hour. This event takes place regularly every week with all kinds of topics. I have decided to use this event as a channel for communicating UX. I have prepared presentation of 53 slides with subject — delivering better user experience. Main purpose of this activity was to educate other colleagues across the company about UX. Slides included definitions of UX, few of the most successful examples, explanation of main aspects of UX, UX maturity model, and what UX activities have already been executed in Y Soft. Feedback from this event can be seen in table 4.2.

	- 2 (the worst)	-1	+1	+2 (the best)
Training content	0.00%	7.14%	42.86%	50%
Presenter skills	0.00%	7.14%	35.71%	57.14%
Knowledge ability of the subject	0.00%	0.00%	35.71%	64.29%
Contribution of the training to your personal development	0.00%	7.14%	64.29%	28.57%
Overall impression	0.00%	0.00%	50.00%	50.00%

Table 4.2: Feedback from technology hour

4.4.3 Prototyping Workshops

Before the beginning of prototyping single SQTA parts I have held prototyping sessions with other colleagues — usually members of product management team, architect team, and developer team. For these sessions I have used technique called Design Studio. Design studio is a methodology invented by Todd Zaki Warfel and Will Evans and works as following [33]:

1. Research informs a well-defined design challenge — for example results from user sessions. Background is presented at the beginning of the studio to define the problem space.
2. Participants break into teams of 4 or 5 for rapid rounds of sketching.
3. After each sketching session the participants present, criticize, and then refine ideas.
4. Take a break. Rinse. Repeat.
5. The whole group gathers together after the third round for regrouping and consensus building.

Outcome of these workshops were stacks of sketches with many possible solutions how to improve current user interface.

Chapter 5

Results

This chapter contains results from implemented user experience experiments. I will evaluate the success of each UX method and present their outputs. At the end of the chapter I will describe my UX recommendations to Y Soft. Some of these methods were more successful than others.

5.1 Personas

I have successfully delivered design personas for product development. Those personas are implemented as eleven HTML documents with photo, descriptive name, priority score based on prioritization done by stakeholders, quote, meet-the-persona narrative, questions and statements, and possible data sources. Set of these documents is called foundation document which serves as a deliverable of this UX method. Whole set is stored on attached DVD. As an example I will show five of them, the ones we used for user tests.

Amanda the Accountant

Amanda is the highest rated persona. She represents the segment of users that use the MFP daily and probably most of the time. Typically, these users are accountants, bankers, etc. She has to print, because her job demands that. This persona is captured in figure 5.1.

Sean the Swift

This persona embodies somebody whose main priority is to stop wasting time at MFP. Operating with MFP faster would help Sean focus on more important duties in his work. Usually managers or higher managers classify among these personas, see figure 5.2.

Timmy the Thrifty Student

Timmy is archetype of users that have to pay for their printing and copying. Timmy expects that there will be no complications when using the SafeQ. He also wants to know how to reduce printing costs and what is his current balance. Most of the time the persona of Timmy portrays students. Figure 5.3 displays this persona.



[link to photo](#)

AMANDA THE ACCOUNTANT

(I need to Print/Scan/Copy)

QUOTE:

" Printing a lot - I have to. "

PRIORITY SCORE:

124

QUESTIONS:

- Oops. I didn't want to print so many copies. How do I cancel the printing?
- Is it necessary to do this?
- I just want a printer which can print, scan and copy, nothing more.

MEET-THE-PERSONA:

Amanda arrives into work early. After arrival she checks her emails and after that she attends daily operative meeting. Her daily job is to check, correct and upload papers into information system.

She also has to make bank payments so she must be careful not to make any mistake and be comfortable with numbers. When Amanda has some problem, she goes to her boss and asks for advice.

Amanda has to print many times everyday (reports for parent company, papers for documentation, ...) and answer to many calls through the day. Sometimes Amanda gets frustrated while accidentally printing too many copies of documents. Then she has to print everything again.

STATEMENTS:

- Hardware buttons seem to never work.

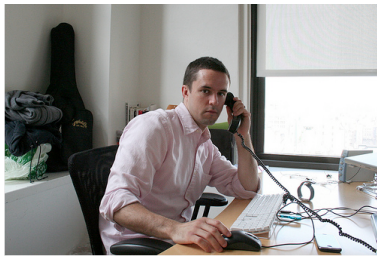
DATA SOURCES AND/OR SOURCES OF ASSUMPTIONS:

- Accountant's average day (Interview on skype)
- [A Day in the life of a Accountant/Auditor](#)

Figure 5.1: Amanda — the persona with the highest score, represents the segment of users that use the MFP daily and probably most of the time.

Tamara Timid

Tamara covers the segment of end users that need to feel secured while using MFP. These users are often secretaries, accountants, finance employees, bankers, and lawyers using



[link to photo](#)

SEAN THE SWIFT

(I want to save time)

QUOTE:

"I care about time."

PRIORITY SCORE:

77

QUESTIONS:

- I forgot to make this print B/W. Do I have to do it all again?
- Can I make more things at once?

MEET-THE-PERSONA:

Sean works as a project manager. He has to attend many important meetings through his day. Almost every one of them requires printed presentations or reports.

Sean wants to stop wasting time at printer by optimizing his workflow and getting similar things done at once. This would help Sean to focus on more important duties in his work and get appreciated.

STATEMENTS:

- I like new technology. If only it would let me do more automatically.

DATA SOURCES AND/OR SOURCES OF ASSUMPTIONS:

- Making the MFPs think (Feature Stories) - Brenda, Susan

Figure 5.2: Sean — he cares about the time. His main priority is to stop wasting time at MFP.

shared MFP. Tamara is captured in figure 5.4.

Cyril Clumsy

The persona of Cyril represents older people who feel old for changes. It's a part of end users that didn't grow up with technology, but has to deal with it anyway. I have also incorporated accessibility issue — Cyril often forgets his glasses to outline that there might be accessibility issues with low vision or color blindness. All details can be seen in figure 5.5.

5.1.1 Achievements

Personas helped fulfill some important tasks. Firstly, it helped me as a designer to understand how other stakeholders think of our end users — who they are, what they need, and how do they solve it. Assumption gathering workshop turned out very beneficial as



[link to photo](#)

**TIMMY THE
THRIFTY
STUDENT**
(I need to save my money)

QUOTE:

" This is a paid service? OK but I expect nothing will go wrong because I pay for this. "

PRIORITY SCORE:

77

QUESTIONS:

- How much my prints cost me?
- Whats my current balance?

MEET-THE-PERSONA:

Timmy is student at a large university. University integrated credit system enables him to use the same account for copying, printing, scanning while also paying for dorm room, meals and books.

About once a week Timmy visits school library, where he prints his essays or scan study materials. Sometimes Timmy forgots his student card.

When Timmy is in need, he visits his friends on dorm with private printer.

STATEMENTS:

- I always have less on my account than I think.

**DATA SOURCES AND/OR
SOURCES OF ASSUMPTIONS:**

- Making the MFPs think (Feature Stories) - Martin

Figure 5.3: Timmy has to pay for his printing and copying. Typically, Timmy is a student at university using SafeQ to bill and manage printing.

stakeholders ground out their opinions. Secondly, personas were used to recruit participants for user testing sessions. We managed to recruit five participants for each external user test based on deliverable that has been shared across company. I have also applied information from foundation document to verify whether the recommended participant is really representing specific persona.

We plan to reincarnate (reuse some or all of the data, incorporate new data, and create new or significantly updated personas) few of the personas in next marketing project. This project is called decision process mapping and should result into incorporating personas into marketing framework to understand how potential customers decide when buying print management solution. Following marketing activities should then lead to higher amount



[link to photo](#)

TAMARA TIMID

(I want to be safe)

QUOTE:

" I don't want anyone else to see what I print "

PRIORITY SCORE:

72

QUESTIONS:

- How can I print this securely?
- Where are my documents?

MEET-THE-PERSONA:

Tamara works in a busy office as a secretary and sends dozens of print jobs to the printer every day. With a shared printer in a hallway sometimes Tamara can't find her printed documents.

An average day for Tamara is to make her duties asap and then surf web (recipes, howtos, woman magazines, ...). She also makes many calls to her son and husband during day.

Tamara sometimes prints a few recipes and doesn't want her boss to see them. Her passion is healthy lifestyle.

DATA SOURCES AND/OR SOURCES OF ASSUMPTIONS:

- Making the MFPs think (Feature Stories) - Monica

Figure 5.4: Tamara needs to feel safe when using MFP. She does not want anyone to see her print jobs.

of generated leads (customer who somehow manages to communicate with sales representatives, for example fills website form, etc.). Reincarnation is due to the fact that design personas are not marketing personas. Collecting new appropriate set of data will lead to revisiting the processes in conception and gestation phase. My proposal for future usage of personas is to begin gathering data from end users by visiting their companies or partners and transforming these data into data driven personas. Another suggestion which I want to bring to bear is to use foundation documents only as a storehouse and use personas artifacts (artifacts are many ways to communicate personas, including different types of documents, posters, handouts, activities, and other materials) for communication. With more effort data driven personas could be used across the organization.

5.2 User Testing

I have conducted five user tests in total. Two of them were usability tests, one guerrilla test, and two hallway tests. Guerrilla and hallway tests were used for rapid prototype validation.



[link to photo](#)

CYRIL CLUMSY

(I want things to stay simple)

QUOTE:

"I am 55, too old for changes."

PRIORITY SCORE:

57

QUESTIONS:

- It has so many buttons. What should I do?
- Why must be printing so hard?

MEET-THE-PERSONA:

Cyril works as a sport teacher in a highschool. Part of his job is to prepare posters, reports and documents for sport events. Many times happens that Cyril prints full color pictures to his posters and makes large expenses.

Sometimes Cyril forgets his reading glasses and can't read what he is printing. He doesn't like the MFP - learning new things takes a month.

STATEMENTS:

- I can't see well. I need glasses to read the text.

DATA SOURCES AND/OR SOURCES OF ASSUMPTIONS:

- [Older Adults and Technology Use](#)
- [Old people print EVERYTHING to prove how out of touch they are](#)

Figure 5.5: Cyril Clumsy is too old for changes. He wants things to stay simple.

Goals, metrics and results from usability tests will be evaluated in separate sections. For every usability test were recruited five participants based on selected personas — Timmy the Thrifty Student, Cyril Clumsy, Sean Swift, Tamara Timid, and Amanda the Accountant. Generally, the tasks for every participants were login, scan, copy, print, and logout with slight modification for every persona (every persona had a story, for example Timmy the Thrifty Student had to scan a page from scripts, Sean Swift representing manager had to print questionnaire marked as a favorite for his employees, Tamara Timid had to copy confidential document, etc.). These tasks can be found on attached DVD.

5.2.1 First Usability Test

First usability test took place on 28.11.2014 in Y Soft offices. Subject of testing was Fuji Xerox embedded terminal. Here is a list of mine and colleagues' most important notes taken from this session:

- Users wanted to scan/print through native applications (Icon and SafeQ label in MFP dashboard is not understandable enough)
- Users miss the “back” button
- Missing feedback, whether the operation has ended — users orient themselves by sound of the printer
- Scan workflows have confusing concept, Tamara doesn’t trust that SafeQ will scan into her folder
- Users don’t understand the icons: scan, print all, settings, trash
- Users expect some sort of guidance (insert your document, fill your email, operation has ended, scan has been sent to your email, you’ve selected billing code, etc.)
- They look for copying in SafeQ, they don’t know they have to go back to dashboard
- Users are confused about favorite/unfavorite and trash buttons
- Users look for software logout button in SafeQ
- Users would like to know what every button does
- Users don’t like the “Save” submit button on software keyboard

As mentioned in section 4.2.1, I have measured these UX metrics — multilevel task success, time on task, errors, and subjective likes, dislikes, and recommendations. Tables with measured metrics and charts can be found on attached DVD. Table 5.1 shows task success for individual personas.

	Login	Scan	Copy	Print	Logout
Amanda	2	3	3	3	2
Tamara	1	4	1	2	1
Timmy	2	2	4	2	1
Sean	1	2	3	2	1
Cyril	4	4	3	3	2

Table 5.1: Multilevel task success results. 1 — No problem, 2 — Minor problem, 3 — Major problem, 4 — Failure/give up

Better visualisation of tasks success is shown in figure 5.6 that shows the percentage of users who fall into each category or level, including failures.

I have used recorded sessions to measure time on task with timestamps shown in media player. Time data is arranged in table 5.2. This table also shows summary data, including the average, median, geometric mean, and confidence intervals for each task.

Collected errors are captured in table 5.3 with average number of errors per task. For multiple error opportunities, number of errors will vary between 0 and the maximum number of error opportunities. The errors have been observed during reviewing records after the session was over.

After the user test, I have asked every participant to rate tasks by difficulty with number from range 1–5 (each task could be assigned to one number). After summing up all their

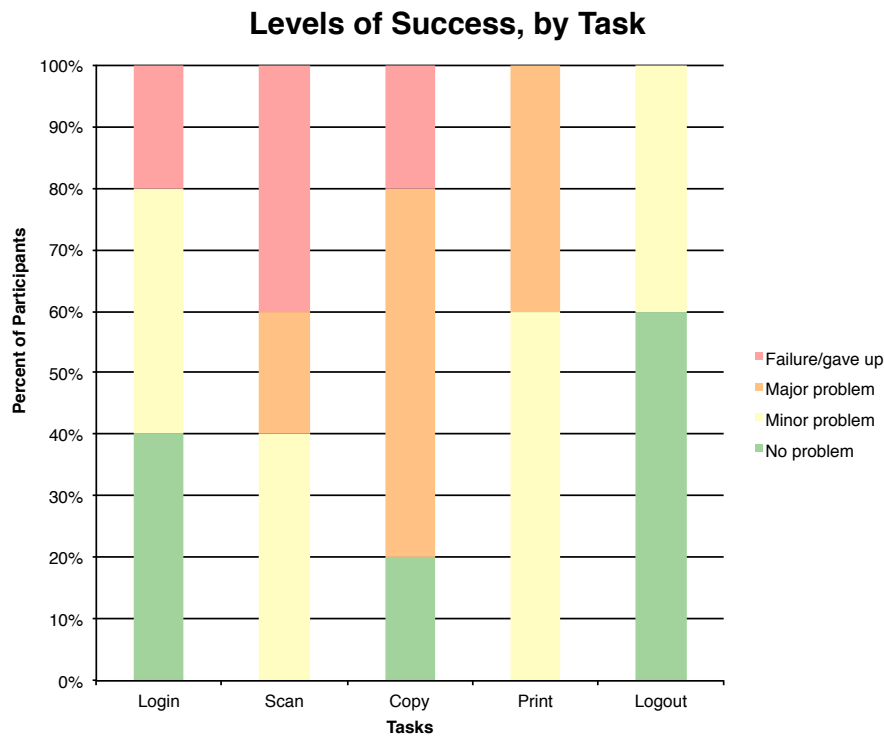


Figure 5.6: Stacked bar chart showing different levels of success based on task completion for first usability test.

scores, I have found that users find scan as the most difficult MFP operation. Following was copying, then printing, login, and logout was last.

By streaming the test, I have received feedback for my test mentoring. I have also realized while reviewing records that sometimes my guidance of the user was apparent. Sometimes, I have asked too many suggestive questions. The feedback made me realize that I should eliminate these issues until next usability test.

5.2.2 Second Usability Test

Second usability test took place on 19.5.2015 in new Y Soft R&D offices. Subject of testing was Axure prototype based on remarks from first usability test. I have measured the same metrics to see whether I have improved the user experience.

Measured success of tasks per participant can be seen in table 5.4. Figure ?? shows that task success has improved from last usability test.

Time data for second usability test is stored in table 5.5. Again, when compared to data from first usability test, there is significant improvement mostly in scan and print task — these times might differ from real implementation, the Axure prototype was robust and became slower, native application may run faster. Also, embedded terminal with the same UI and resistive touch display might run slower due to the computing limitations of the printer. The comparison is captured in figure 5.8. Of course, the success of task affects time spent on task.

There is only slight improvement of time on copy task, but still the guiding illustration

	Login	Scan	Copy	Print	Logout
Amanda	14	295	179	176	68
Tamara	3	250	103	135	9
Timmy	60	137	87	47	4
Sean	69	147	140	77	3
Cyril	66	508	207	457	2
Mean	42.4	267.4	143.2	178.4	27.6
Median	60	250	140	135	9
Geometric Mean	25.820	237.428	135.976	131.483	13.172
90% confidence interval	23.067	110.618	37.031	120.342	22.784

Table 5.2: Time spent performing individual tasks in first usability test.

	Login	Scan	Copy	Print	Logout
Amanda	0	3	4	5	1
Tamara	0	4	0	2	0
Timmy	1	1	0	2	0
Sean	0	0	4	2	0
Cyril	0	0	2	0	0
Average number of errors	0.2	1.6	2	2.2	0.2

Table 5.3: Errors per persona for single tasks in first usability test.

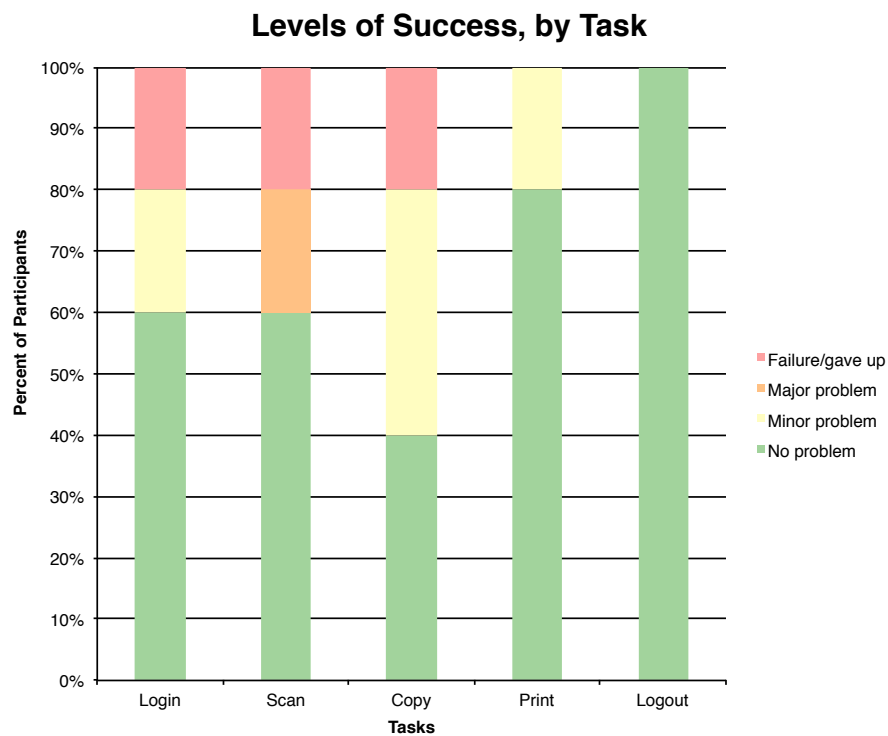


Figure 5.7: Improvement of task success is apparent in second usability test.

with label helped participants to finish task with fewer problems and errors. The error data

	Login	Scan	Copy	Print	Logout
Amanda	4	4	1	1	1
Tamara	1	1	2	1	1
Timmy	2	3	1	1	1
Sean	1	1	2	1	1
Cyril	1	1	4	2	1

Table 5.4: Multilevel task success results for second usability test.

	Login	Scan	Copy	Print	Logout
Amanda	22	194	28	16	13
Tamara	3	21	63	11	2
Timmy	19	77	38	6	4
Sean	3	130	88	8	4
Cyril	18	33	378	82	6
Mean	13	91	119	24.6	5.8
Median	18	77	63	11	4
Geometric Mean	9.250	66.957	74.072	14.727	4.780
90% confidence interval	6.802	52.776	107.873	23.766	3.138

Table 5.5: Time spent performing individual tasks in second usability test.

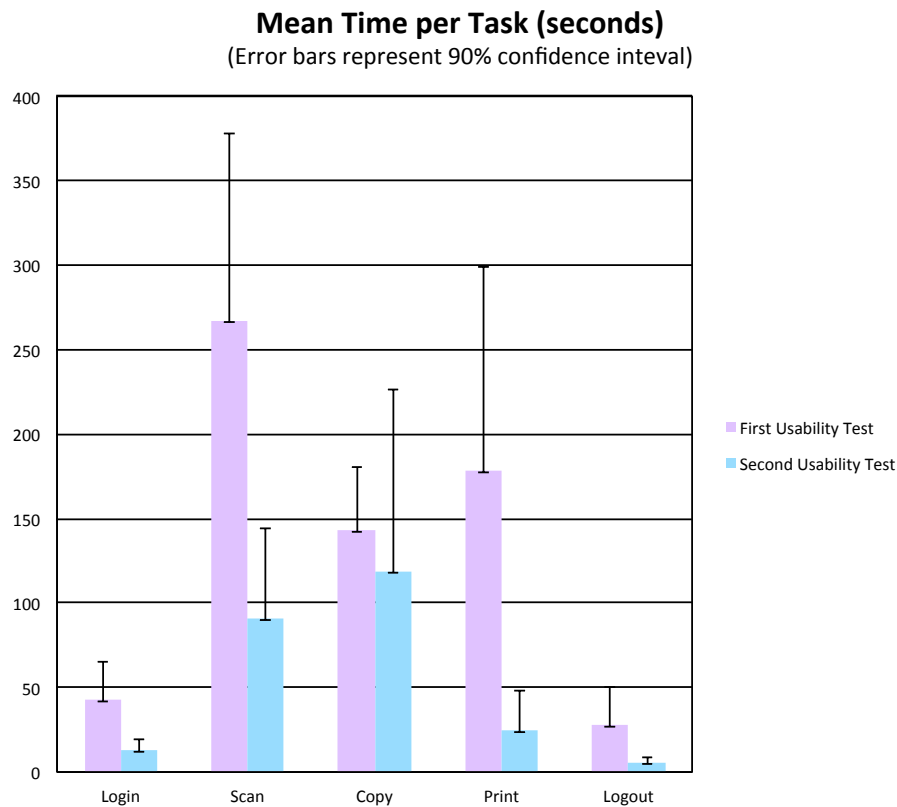


Figure 5.8: Comparison of time on task in both usability tests.

for second usability test are captured in table 5.6. A visible improvement can be seen for copy and print task. When interacting with prototype there is one error less in average for copy task and for print no error even occurred.

	Login	Scan	Copy	Print	Logout
Amanda	1	2	0	0	0
Tamara	0	0	1	0	0
Timmy	1	3	0	0	0
Sean	0	1	2	0	0
Cyril	0	0	2	0	0
Average number of errors	0.4	1.2	1	0	0

Table 5.6: Errors data in second usability test.

As can be seen, there is no improvement for login screen — participants tend to swipe card in front of tablet rather than card reader. But incorporating keypad to PIN authentication screen reduced time spent on task.

Again, I have asked participants to rate tasks by perceived difficulty. After the second test, copying and print was perceived as equally difficult, following was scan task, login, and logout as last. Interestingly, the distribution of score was very similar for copy (19), print (19), and scan (17) — the difference between scan and copy was only 2. This subjective evaluation results that users in second usability test perceive all the operations as equally difficult. Both prioritization tables can be found on attached DVD with all measured metrics.

New issues emerged during the second usability test. In following prototyping iteration should be addressed these issues:

- Scan to email should be divided into two workflows — scan to my email with pre-filled email and scan to others email with popup dialog including text input for email
- Incorporate check mark icon, that the operation has ended
- Translate prototype into Czech — users are used to MFP in their native language
- Billing codes term is still confusing — users answered that simple walk-through with “Don’t show next time” could help them understand the meaning of billing codes
- Users expect they can copy in SafeQ interface
- A login screen with card authentication should tell users where is the card reader — incorporate simple animation or arrow to navigate users to card reader

There were also few positive subjective feedbacks — tamara liked the icons with labels, she found it more user friendly, Timmy thought that using the MFP through capacitive touch display of attached tablet was much better than through embedded resistive MFP touch display. Also, I haven’t noticed any negative feedback on my mentoring.

5.3 Integration of UX

Another result of this thesis is my proposal for company like Y Soft. To fully integrate user experience into whole company, there is a dire need of establishing the UX processes.

This will also reduce the workload that has been brought upon me. I have consulted my proposal with three leading UX designers in Czech republic — Martin Kopta, Ondřej Válka and Leoš Berka. I will describe what processes need to be established to retain and improve UX quality of product portfolio and then I will describe the team that could accomplish this state. This proposal is a consulted hypothesis that exceeds the scope of this thesis but should be explained for future work.

5.3.1 UX processes

End users evolve with aging products. This means that the needs which users have had before might not be the same needs in the future. The product may solve few of their needs but new ones will eventually emerge. I propose a validation of personas before every release to gain new research data for new designs. Another process that could repeat in a year or half a year period would be some motivational questionnaire for partners to get insight how to enhance the product. This could help both sides. To incorporate agile UX into company I suggest these UX activities based on section 2.4:

- establish UX sprints with one week duration — that should be more agile approach to sudden design requirements than three week developer sprints
- design review and planning at the end of each UX sprint
- include UX demo into developer demo at the end of the developer sprint
- be one sprint ahead than developers — prepare design data in advance as mentioned in agile UCD [23]
- enact kick-off meetings representing Cycle 0. Product owner, team leader, product manager, UX designer, technical consultants from customer support service, sales manager, almost every possible stakeholder should attend the kick-off meeting. Kick-off meeting is the brief requirements-gathering phase at the start of the project useful for designer.

It is possible, that there will be no spare UX designers for every product in company portfolio. To deliver satisfactory UX even without UX designer there should be some developer UX education system. This includes UX workshops which will be held by UX designers with goal of educating the lead developers. Another proposal is to create brief flyers for new developers that would summarize how to sketch and hallway test.

To support internal marketing of UX activities I propose these activities:

- new designs and free food — event that gathers feedback from colleagues
- include few slides about upcoming UX activities into product news. Product news is a regular streaming event for whole company held by product managers
- once in a while create posters with interesting data about end users to support user centered design across whole organization

The last proposal is to start cooperation of UX team with hardware designers. UX designers might be able to form some user requirements into industrial design of external terminals.

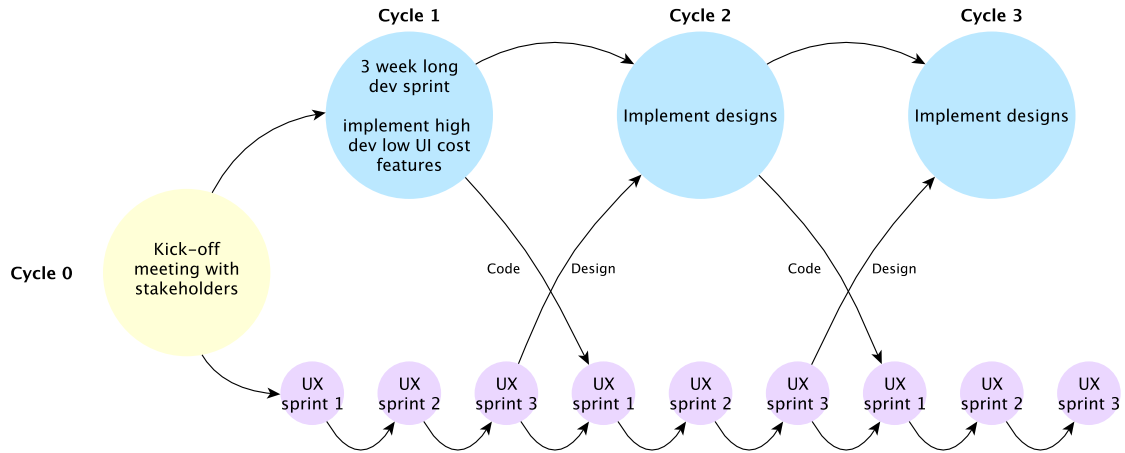


Figure 5.9: I suggest being one sprint ahead of developers, and then pass on the validated designs to be implemented. The figure shows two tracks — developer track with 3 week sprint, and interaction track with 1 week sprint. Developers and designers exchange deliverables between themselves to ensure that the product is validated.

5.3.2 UX Team

Nielsen mentions that 10% of a project’s budget should be devoted to usability [34]. Because Y Soft has at this time 51 developers, I suggest creating UX team consisting of five people — three interaction designers, one user researcher, and one visual designer. Another option might be — four interaction designers with visual design skills and one user researcher. The ratio was consulted with Martin Kopta — for three designers there is one researcher. This team should be partially distributed and every designer would be assigned to individual development team to integrate someone with design responsibility. Another suggestion is to relocate designers after half of a year to get fresh ideas for specific projects.

5.3.3 UX Maturity

After nine months of my activity in Y Soft I have found that the maturity of UX has raised. This has been done as a result of great cooperation with all my colleagues. We are currently transiting to a tactical level because of these facts:

- UX designers start to play an integral role of a product management team
- designs are being integrated into product development tasks
- a UX team creation has begun¹
- UX designs are getting trust and credibility
- UX process are forming and are being incorporated

¹during this thesis, company managed to recruit another interaction designer. I have attended the interview and recruiting process.

At first, I was afraid that the developers will find my activities annoying, but I was surprised. After getting their trust, they started to address me with their UI issues and consult their developing decisions.

5.4 Prototyping

The result of this method is a prototype created in a prototyping tool called Axure. The prototype lacks functionality of the printer but simulates the print, scan, login, and logout actions. The copy tab includes a guiding illustration. Generated prototype and source Axure file can be found on attached DVD. The generated HTML prototype can be opened with Firefox or Safari browser (Chrome requires extension installation). The current design of this prototype (after the second usability test) is a collaboration of me and my new colleague working as another interaction designer for Y Soft. It has been translated to Czech for future usability tests. Screens for various parts of the SafeQ application can be seen in following figures.

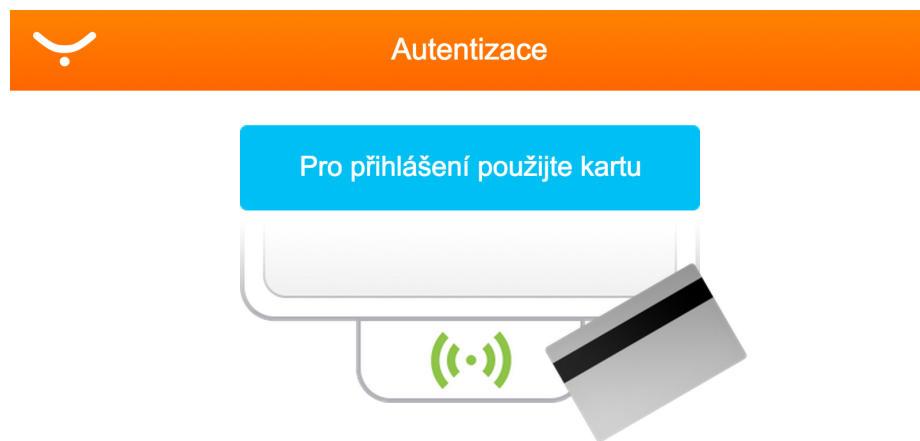


Figure 5.10: Authentication screen with animation showing where to swipe the card.

This prototype has been made as a following action after the first usability test. It has been validated with guerrilla and hallway tests. The last usability test showed progress in task success and time on task. I have also gained a positive feedback. The most important achievement of this method is that this deliverable has been planned into development and currently is in elaboration phase.

The authentication screen features an orange header with a logo on the left, the title "Autentizace" in the center, and an "ODEJÍT" button on the right. Below the header, on the left, is a blue instruction box that says "Zadejte PIN a stiskněte tlačítko OK" above a white text input field. To the right of the input field is a 3x3 grid of buttons: numbers 1-9, a backspace button (arrow and X), 0, and an "OK" button.

Figure 5.11: Authentication screen with keypad and PIN text input.

The print application interface has a header with the "YSOFT SAFEO" logo, user information "Pavel Krátký" and "Zbývajcí kredit: 109 CZK", and an "ODHLÁSIT" button. A left sidebar contains icons for "TISK", "KOPIROVÁNÍ", "SKENOVÁNÍ", and "NÁPOVĚDA". The main area has three tabs: "ČEKAJÍCÍ (1)", "VYTIŠTĚNÉ", and "OBLÍBENÉ". Under the "ČEKAJÍCÍ (1)" tab, there is a job entry "Faktura přijatá" with a checkbox, a timestamp "20.05.2015 18:53:28 / Pavel Krátký / Účtárna", and icons for information and a favorite. A "TISKNOUT" button is at the bottom center.

Figure 5.12: Print application with one waiting job.

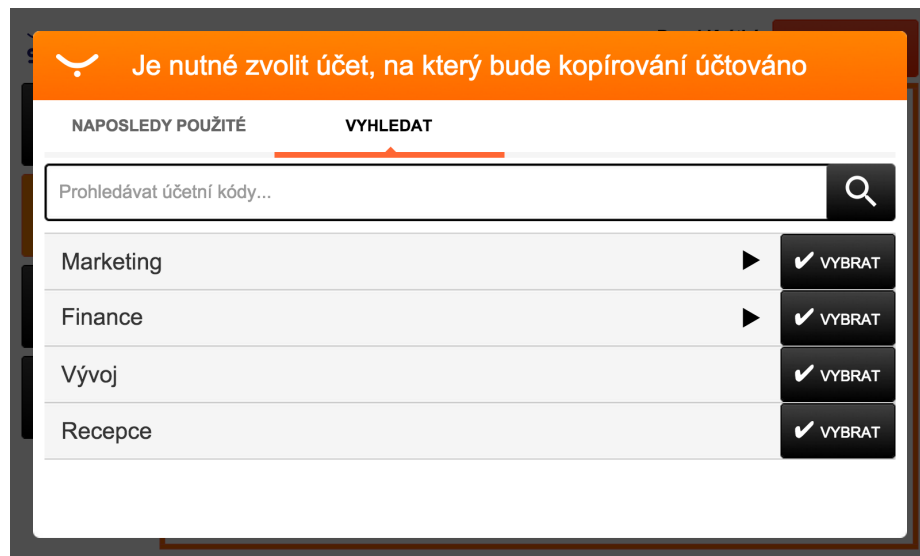


Figure 5.13: Billing code tree structure with search box.

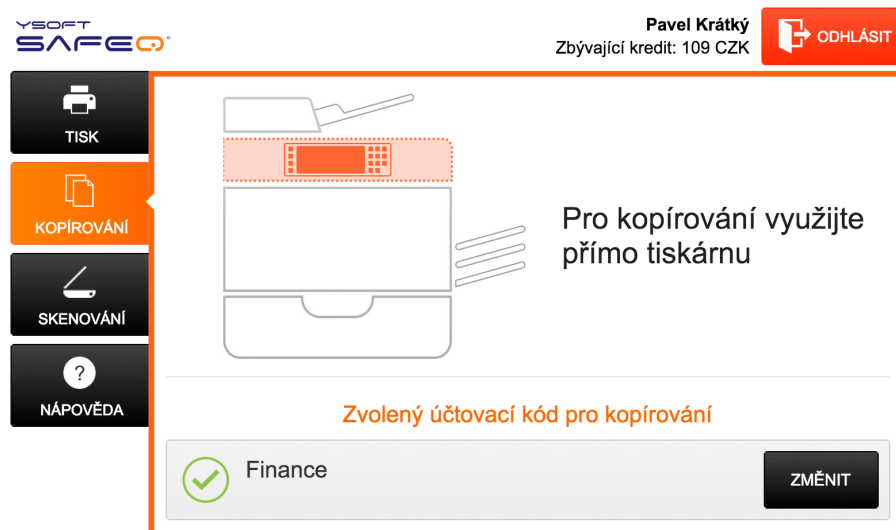


Figure 5.14: Copy application with guiding illustration and label

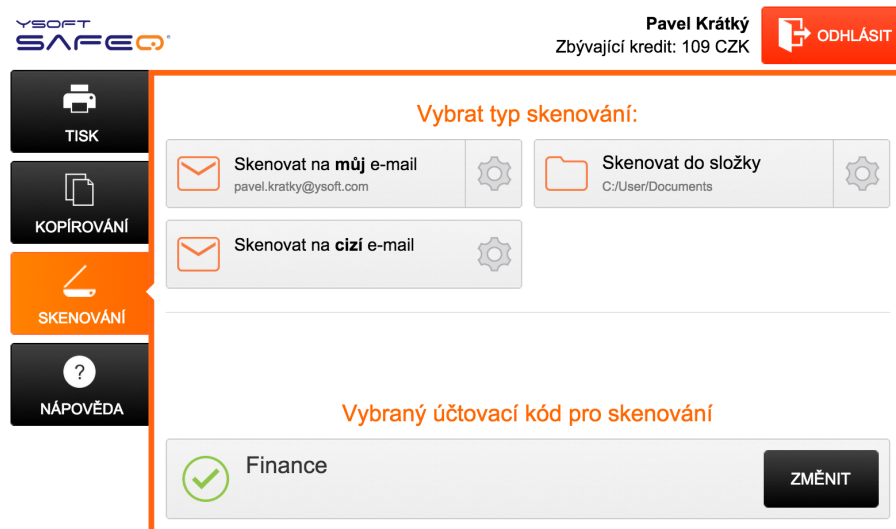


Figure 5.15: Scan application with selected billing code and divided scan workflows.

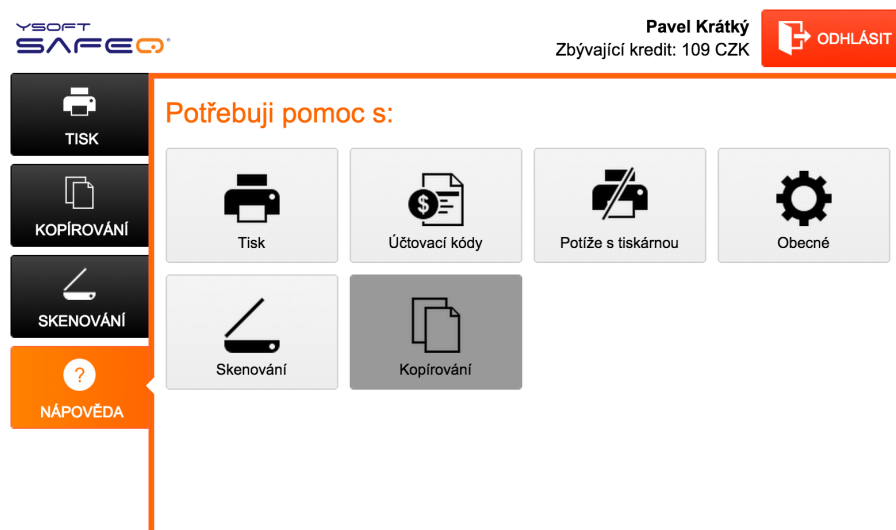


Figure 5.16: First level of help with tiles. User can tap on section that needs help with.

Chapter 6

Conclusion and Future Work

Firstly, I have explained the term “user experience” and its background. Next, I have described what are, in my opinion, the main aspects of user experience, and selected methodology such as personas, user testing, and prototyping. I have also elucidated the possibility of adopting the agile approach to design with users in mind. Lastly, I have mentioned UX maturity with three maturity levels that, in my opinion, suits this thesis.

I have described and analyzed the main product from Y Soft’s portfolio — print management solution SafeQ. I have dedicated all my effort to embedded and external terminals, that’s the part of SafeQ end users must interact with. Users manage their multifunctional printer operations through SafeQ Terminal Application (SQTA). After interviewing the higher stakeholders, I have described the situation of UX maturity in company and company’s development process. Hypotheses with proposed solutions have been formed based on the gathered information.

I have suggested ad hoc personas based on assumptions to understand needs of end users. The result — after two workshops with various stakeholders, I have created foundation document containing eleven personas in total. This process helped me to gather information from minds of stakeholders. Thanks to personas I managed to recruit five participants for each usability test. Another success is that few of the personas are going to be used in future marketing project.

I have used prototypes to implement new ideas and solutions to usability issues found through the first usability test. Firstly, I organized meetings where me and other stakeholders prototyped on paper. Next, I have processed these prototypes into HTML application with prototyping tool called Axure. The prototype has been systematically tested. Guerilla and hallway tests were used to refine and validate the prototype. Second usability test has showed that participants have made fewer errors and spent less time on performing task on prototype. This led to better task success. Tasks and personas remained the same for both usability tests. I have also mentioned what other activities have been done to raise awareness of UX in company. The most important result of these methods — the changes included in prototype have been planned into development and currently is in elaboration phase. This means that I have managed to deliver better UX and will be visible in a real business product.

In fifth chapter, I suggest what UX processes should be established to retain and improve UX quality of product portfolio. This proposal has been consulted with three specialists from UX field. Besides that, I suggest how to incorporate agile design approach to Y Soft’s development process. I propose what UX team should operate in Y Soft, this proposal is based on studies and recommendations from UX specialists. Finally, I have mentioned that

the UX maturity has increased.

I have learned that if you want to be a change maker, you have to start low. Have fast successes with small things and build credibility. I have also learned how to mentor user sessions. Surprisingly, company didn't put up any resistance to my activities, on the contrary they supported me and offered me resources to carry out my experiments. I have also found that after nine months the mentality of developers has changed. They have had resolved UI issues themselves before. Now, they address whether product managers or UX designers to help them with solving these issues.

The integration of UX is a field of study that is still not very well covered and would benefit from further investigation. As a future work, I suggest establishing mentioned UX processes and their evaluation with UX team creation. Another interesting field is measuring the return on investment metric. I also suggest to iteratively improve prototype into its most usable version that could be achieved. Another field of interest is interviewing or remote usability testing end users in foreign countries — Japanese, Arab or Russian users might have different needs and goals than Europeans. Finally, I propose creating the content of help in SQA with application of UX method called card sorting.

This thesis is a proof that you can substantially improve usability of existing product. That's why I have enjoyed working on it and I would like to continue practicing UX and obtaining new experiences in this vast field.

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